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OF THE

AMERICAN CLIMATOLOGICAL AND CLINICAL ASSOCIATION.

FOR THE YEAR 1916.

VOLUME XXXII.

"The object of this Association shall be the Clinical Study of Disease, especially of the Respiratory and Circulatory Organs, and of Climatology and Hydrology."—*Constitution.*

PHILADELPHIA:
PRINTED FOR THE ASSOCIATION
1916.

NOTICE.

The Association assumes no responsibility for the statements and opinions expressed in the papers read at its meetings.

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LIST OF OFFICERS.

Presidents.

NAME	YEAR
A. L. Loomis	1884–5
William Pepper	1886
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V. Y. Bowditch	1889
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W. E. Ford	1892
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J. B. Walker	1896
E. Fletcher Ingals	1897
E. O. Otis	1898
Beverley Robinson	1899
Abraham Jacobi	1900
Robert H. Babcock	1901
Samuel A. Fisk	1902
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James C. Wilson	1904
W. F. R. Phillips	1905
E. L. Shurly	1906
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Edward R. Baldwin	1910
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James Alexander Miller	1916
Judson Daland	1917

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NAME	YEAR
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S. A. Fisk, John C. Munro	1897
Beverley Robinson, C. F. McGahan	1898
James A. Hart, R. C. Newton	1899
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A. D. Blackader, Henry Sewall	1906
Frank Fremont-Smith, C. L. Minor	1907
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E. R. Baldwin, C. E. Edson	1909
James M. Anders, H. Longstreet Taylor	1910
Will Howard Swan, John H. Lowman	1911
Herbert Maxon King, Carroll E. Edson	1912
James M. Anders, C. D. Alton	1913
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Arthur K. Stone, James Alex. Miller	1915
Philip King Brown, Henry M. Bracken	1916
W. L. Dunn, J. E. Elliott	1917

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James B. Walker	1884-95
Guy Hinsdale	1895

LIST OF MEMBERS.

Honorary Members.

ELECTED

1888. Abbot, Griffith E., 722, Main Street, Worcester, Mass.
1914. Fox, R. Fortescue, Devonshire Place, W., London.
1914. Garnett, A. S., Hot Springs, Arkansas.
1916. Gorgas, William C., Surgeon-General, U.S.A. War Department, Washington, D.C.
1914. Gros, Edmund L., 23, Ave. du Bois de Boulogne, Paris, France.
1902. McBride, James H., Pasadena, Cal.
1914. Philip, Sir Robert W., Charlotte Square, Edinburgh, Scotland.
O. M. Reed, Boardman, Alhambra, Cal.
O. M. Robinson, Beverley, 42, West 37th Street, New York.
1911. Stupart, Sir Robert F., K.B., F.R.S.C., Director, Dominion Meteorological Service, Toronto, Canada.
1898. Sunderland, Septimus, 11, Cavendish Place, Cavendish Square, W., London.
O. M. Tyndale, J. Hilgard, Richards Block, Lincoln, Nebraska.
1897. Weber, Sir Hermann, 10, Grosvenor Street, W., London, England.
1907. Williams, Leonard L. B., 123, Harley Street, W., London.

Corresponding Members.

1912. Carpenter, Ford A , Weather Bureau, Los Angeles, Cal.
1898. Eyre, G. G., Claremont, Cape Town, South Africa.
1910. Forbes, Mr. N. Hay, F.R.C.S., Church Stretton, England.
1911. Grenfell, Wilfred, C.M.G., St. Anthony, Newfoundland.

O. M., Original Member.

ELECTED

1912. Henderson, Professor Yandell, 440, Prospect Street, New Haven, Conn.
1908. Liston, Major W. Glen, C.I.E., Indian Medical Service, Director of the Bacteriological Laboratory, Bombay, India.
1910. Rogers, Lieut.-Colonel Sir Leonard, C.I.E., F.R.C.S., Indian Medical Service, Professor of Pathology, Medical College, Calcutta, India.
1904. Sandwith, Fleming Mant, 31, Cavendish Square, W., London.
1902. Weber, F. Parkes, 13, Harley Street, W., London.
1914. Wood, Neville, 42, Elvaston Place, Queen's Gate, London.

Emeritus Member.

1885. Ford, William E., Utica, New York.

Active Members.

1914. Alsever, William D., 727, East Willow Street, Syracuse, New York.
1897. Alton, Charles D., 1310, Asylum Avenue, Hartford, Conn.
1899. Anders, James M., 1605, Walnut Street, Philadelphia.
1890. Anderson, B. P., 1231, N. Cascade Avenue, Colorado Springs, Col.
1900. Arnold, Horace D., 520, Commonwealth Avenue, Boston.

1893. Babcock, R. H., 74, East Elm Street, Chicago.
1915. Bailey, Walter C., 506, Beacon Street, Boston.
1898. Baldwin, Edward R., Saranac Lake, N.Y.
1901. Barlow, W. Jarvis, Security Building, Los Angeles, Cal.
1907. Barnes, Harry Lee, Wallum Lake, R.I.
1902. Bergtold, William H., 910, Metropolitan Building, Denver, Col.
1897. Blackader, Alexander D., 236, Mountain Street, Montreal, Canada.
1914. Blue, Rupert, Surgeon-General, U.S. Public Health Service, Washington, D.C.
1895. Boardman, W. S., 63, Mt. Vernon Street, Boston.
1897. Bonney, S. G., Stedman Building, Denver, Col.

ELECTED

1885. Bowditch, V. Y., 506, Beacon Street, Boston.
1901. Bracken, Henry Martyn, 1010, Fourth Street, S.E., Minneapolis, Minn.
1891. Brannan, John W., 48, West 51st Street, New York City.
1894. Bridge, Norman, Temple Auditorium, Los Angeles, Cal.
1903. Brown, Lawrason, 104, Main Street, Saranac Lake, N.Y.
1903. Brown, Philip King, 516, Sutter Street, San Francisco, Cal.
1897. Brown, Sanger, Kenilworth, Illinois.
1907. Browning, Charles C., Merritt Building 8 and Broadway, Los Angeles, Cal.
1909. Bushnell, George E., U.S.A., Fort Bayard, New Mexico.
1886. Butler, G. R., 226, Gates Avenue, Brooklyn.
1914. Byers, John Roddick, Ste. Agathe des Monts, P.Q., Canada.

1896. Campbell, W. A., 424, N. Nevada Ave., Colorado Springs, Col.
1910. Carrington, P. M., U.S. P.H. Service, San Diego, Cal.
1906. Claytor, Thomas A., 1826, R. Street, N.W., Washington, D.C.
1901. Cobb, J. O., U.S. P.H. Service, Marine Hospital, Chicago.
1894. Coleman, Thomas D., 505, Greene St., Augusta, Ga.
1901. Collins, Charles Farnham, 50, West 55th Street, New York City.
1889. Coolidge, A., jun., 613, Beacon Street, Boston.
1910. Crane, Bayard T., Rutland, Mass.

1907. Da Costa, John C., jun., 264, South 15th Street, Philadelphia.
1892. Daland, Judson, 317, South 18th Street, Philadelphia.
1890. Darlington, Thomas, 27, Washington Square North, New York City.
1907. Darnall, Wm. Edgar, 1704, Pacific Ave., Atlantic City.
1897. Davis, N. S., 7, West Madison Street, Chicago.

ELECTED

1910. Dixon, Samuel G., Harrisburg, Penn.
1905. Dunn, William LeRoy, Asheville, N.C.

1897. Edson, Carroll E., McPhee Building, Denver, Col.
1915. Elliott, John Barnwell, jun., 608, Maison Blanche, New Orleans, La.
1903. Elliott, J. H., 11, Spadina Road, Toronto, Canada.

1912. Farrand, President Livingston, Boulder, Colorado.
1910. Floyd, Cleaveland, 246, Marlborough Street, Boston, Mass.
1911. Fulton, Frank Taylor, 36, Prospect Street, Providence, R.I.

1896. Gardiner, C. Fox, 818, North Cascade Avenue, Colorado Springs, Col.
1892. Gibson, William M., 260, Genesee Street, Utica, N.Y.
1915. Goodman, Edward H., 248, South 21st Street, Philadelphia.
1909. Griffin, Walter Alden, Sharon, Mass.

1907. Hall, J. N., 452, Metropolitan Building, Denver, Col.
1912. Hamman, Louis, 714, Park Avenue, Baltimore.
1893. Hance, I. H., Lakewood, N.J.
1891. Hart, James A., P.O. Box 144, Geneva, N.Y.
1912. Hastings, Thomas W., 172, East 71st Street, New York.
1912. Hatfield, Charles J., 2008, Walnut Street, Philadelphia.
1914. Hawes, John B., 2nd, 29, Gloucester Street, Boston, Mass.
1896. Heffron, John L., 608, East Genessee Street, Syracuse, N.Y.
1912. Hewlett, A. Walter, Leland Stanford University Medical School, Sacramento, and Webster St., San Francisco, Cal.
1893. Hinsdale, Guy, Hot Springs, Virginia.
1902. Hoagland, Henry W., 818, North Nevada Avenue, Colorado Springs, Col.
1914. Holden, G. Walter, Agnes Memorial Sanatorium, Denver, Colorado.

ELECTED

O. M. Ingals, E. Fletcher, Monroe Buildings, 104, So. Michigan Boulevard, Chicago.

1889. Jacobi, A., 19, East 47th Street, New York.
1888. Jayne, W. A., 408, Metropolitan Building, Denver, Col.
1901. Jennings, Charles Godwin, 457, Jefferson Street, Detroit, Michigan.
1915. Johnston, Collins H., 87, Monroe Ave., Grand Rapids, Michigan.

1904. King, Herbert Maxon, Liberty, New York.
1907. Kinghorn, Hugh M., 14, Church Street, Saranac Lake, N.Y.
1899. Klebs, Arnold C., c/o M. Forbes and Co., Sears Bldg., Boston.

1910. Landis, H. R. M., 11, South 21st Street, Philadelphia.
1914. Lee, Roger I., Harvard University, Cambridge, Mass.
1914. Lichty, John A., 4634, Fifth Avenue, Pittsburg, Pa.
1909. Locke, Edwin Allen, 311, Beacon Street, Boston, Mass.
1913. Lord, Frederick T., 305, Beacon Street, Boston.
1904. Lowman, John H., 1807, Prospect Ave., S.E., Cleveland, O.
1907. Lyman, David Russell, Wallingford, Conn.

1906. Manges, Morris, 72, East 79th Street, New York.
1902. Marvel, Philip, 1616, Pacific Avenue, Atlantic City, N.J.
1887. Mays, Thomas J., 1829, Spruce Street, Philadelphia.
1915. Mercur, Wm. H., 5244, Fifth Ave., Pittsburg, Pa.
1905. Miller, James Alexander, 379, Park Ave., New York.
1909. Miner, Charles H., 115, South Franklin Street, Wilkesbarre, Pa.
1909. Miner, Stanley G., 58, Cadillac Square, Detroit, Mich.
1899. Minor, Charles L., Asheville, N.C.
1909. Morgan, James Dudley, 919, Fifteenth Street, N.W., Washington, D.C.

ELECTED

1895. Newton, R. C., 42, Church Street, Montclair, N.J.
1907. Nichols, Estes, 188, State Street, Portland, Maine.
1907. Nichols, John B., 1321, Rhode Island Ave., N.W., Washington, D.C.
1912. Norris, George W., 1530, Locust Street, Philadelphia.

1888. Otis, E. O., 381, Beacon Street, Boston.

1913. Parfitt, C. D., Gravenhurst, Ontario, Canada.
1912. Paterson, Robert Childs, Saranac Lake, New York.
1906. Perkins, Jay, 125, Waterman Street, Providence, R.I.
1895. Phillips, W. F. R., School of Medicine, Charleston, S.C.
1887. Platt, Walter B., 802, Cathedral Street, Baltimore.
1902. Pottenger, F. M., 1100, Title Insurance Building, Los Angeles, Cal.
1905. Pratt, Joseph H., 317, Marlborough Street, Boston.
1914. Probst, Charles O., 185, State Street, Columbus, Ohio.
1905. Pryor, John H., 26, Linwood Ave., Buffalo, N.Y.

1891. Quimby, Charles E., 278, West 86th St., New York.

1885. Rice, C. C., 123, East 19th Street, New York.
1901. Richardson, Charles W., 1317, Connecticut Avenue, Washington, D.C.
1904. Richer, A. J., Ste. Agathe des Monts, Province of Quebec, Canada.
1890. Robinson, W. D., 2012, Mt. Vernon St., Philadelphia.
1902. Rochester, Delancey, 469, Franklin Street, Buffalo.
1890. Rogers, E. J. A., 222, Colfax Avenue, Denver, Col.

1905. Schauffler, William Gray, 400, Madison Ave., Lakewood, N.J.
1901. Sewall, Henry, 1360, Vine Street, Denver, Col.
1915. Shattuck, George Cheever, 205, Beacon Street, Boston.
1910. Shurly, B. R., 32, Adams Avenue W., Detroit, Mich.
1887. Smith, Frank Fremont, Bar Harbor, Maine.
1911. Steiner, Walter R., 4, Trinity Street, Hartford, Conn.

ELECTED

1909. Stevens, Martin L., Asheville, N.C.
1904. Stone, Arthur K., 44, Fairfield St., Boston, Mass.
1915. Stone, Willard J., Colton Building, Toledo, Ohio.
1910. Swan, John M., 457, Park Avenue, Rochester, N.Y.
1901. Swan, Will Howard, 1440, North Nevada Avenue, Colorado Springs, Col.

1892. Taylor, H. Longstreet, 810, Lowry Building, St. Paul, Minn.
1907. Taylor, J. Gurney, 330, Wells Building, Milwaukee, Wisconsin.
1896. Taylor, J. Madison, 1504, Pine Street, Philadelphia.
1910. Thomas, John D., 1726, M. Street, N.W., Washington, D.C.

1911. White, William Charles, Bedford Ave. and Wandless St., Pittsburg, Pa.
1898. Whitney, H. B., 320, Temple Court, Denver, Col.
1898. Williams, Harold, 528, Beacon Street, Boston.
1885. Williams, H. F., 416, Grand Avenue, Brooklyn.
1911. Williams, Linsly R., Albany, New York.
1910. Wilson, Gordon, 4, East Preston St., Baltimore.
O. M. Wilson, James C., 1509, Walnut Street, Philadelphia.
1913. Wood, Nathaniel K., 520, Beacon Street, Boston.

MINUTES.

The Thirty-third Annual Meeting of the Association was held in Washington, D.C., at the Hotel Willard, Dr. James Alexander Miller, the President, in the chair. The following members were present during the Sessions:—

W. D. Alsever,
C. D. Alton,
J. M. Anders,
H. D. Arnold,
R. H. Babcock,
E. R. Baldwin,
H. L. Barnes,
A. D. Blackader,
W. S. Boardman,
S. G. Bonney,
V. Y. Bowditch,
H. M. Bracken,
J. W. Brannan,
L. Brown,
P. K. Brown,
C. G. Jennings,
H. M. Kinghorn,
A. C. Klebs,
H. R. M. Landis,
R. I. Lee,
J. A. Lichty,
J. H. Lowman,
D. R. Lyman,
M. Manges,
P. Marvel,
J. A. Miller,
C. L. Minor,
J. B. Nichols,
E. O. Otis,
C. D. Parfitt,
Jay Perkins,
T. A. Claytor,
T. D. Coleman,
A. Coolidge, Junr.
B. T. Crane,
J. Daland,
T. Darlington,
W. E. Darnell,
W. L. Dunn,
C. E. Edson,
J. H. Elliott,
L. Farrand,
C. Floyd,
F. T. Fulton,
C. F. Gardiner,
W. A. Griffin,
J. N. Hall,
I. H. Hance,
C. J. Hatfield,
Guy Hinsdale,
H. W. Hoagland,
G. W. Holden,
E. F. Ingals,
A. Jacobi,
W. F. R. Phillips,
W. B. Platt,
J. H. Pratt,
C. O. Probst,
C. W. Richardson,
W. D. Robinson,

Delancey Rochester,
W. G. Schauffler,
Henry Sewall,
G. C. Shattuck,
B. R. Shurly,
Fremont Smith,
W. R. Steiner,
M. L. Stevens,
A. K. Stone,
J. M. Swan,
W. H. Swan,
J. Gurney Taylor,
J. M. Taylor,
J. D. Thomas,
W. Charles White,
Linsly R. Williams,
Gordon Wilson,
J. C. Milsom,
N. K. Wood.

The minutes of the thirty-second Annual Meeting were reported by the Secretary as having been printed in the annual volume and sent to each member. The minutes of the Council meetings were then read and adopted.

The Secretary and Treasurer made his report and financial statement (*q.v.*).

The President appointed a Nominating Committee consisting of Drs. Minor, Anders, Darlington, Gardiner, and Babcock, and an Auditing Committee consisting of Drs. Landis and Lyman. The business session then adjourned.

The following amendment to Article III of the Constitution was unanimously passed :—

Section 4.—Anyone who has been an active member of this Association for twenty (20) years in good standing, and has attained the age of sixty (60) years, may become an Emeritus member by expressing his desire to do so, in writing to the Council, and he shall thereafter be exempt from all dues and duties of the Association.

The afternoon was devoted to a scientific session of the Congress of American Physicians and Surgeons at the New Willard Hotel. In the evening a reception was tendered to the President of the Congress, Dr. Wm. S. Thayer.

Second Day, May 10.

The Nominating Committee reported the recommendation of the following ballot for the election of officers for the ensuing year: President, Dr. Judson Daland; Vice-

Presidents, Dr. W. L. Dunn and Dr. J. H. Elliott; Secretary and Treasurer, Dr. Guy Hinsdale; Member of the Council, Dr. J. A. Miller; Delegate to the Executive Committee of the Congress of American Physicians and Surgeons, Dr. Thomas Darlington and Dr. Lawrason Brown, alternate. On motion, duly made and seconded, the Secretary was directed to cast the ballot, and the foregoing were declared elected.

The Council subsequently elected Dr. W. D. Robinson, Recorder.

The Committee stated that they had considered invitations to hold the next meeting at Philadelphia, New York, Baltimore, and Chicago; they recommended, however, that Lakewood, New Jersey, be chosen, and the Association then voted in favour of Lakewood.

Dr. Steiner said, in reference to the election of a member of the Executive Committee of the Congress of Physicians and Surgeons and alternate: They should be elected at our next meeting after the triennial session of the Congress. It is all right to elect them now, provided it is understood that they take office after our next meeting. All the members of the Executive Committee are elected at the meeting after the common session.

Under miscellaneous business, the Secretary referred to the recommendation of the Bill now before Congress with relation to the "Care and Treatment of Indigent Consumptives in the United States," and also with reference to the Federal Commission on Tuberculosis; and whether the Association will support the proposition to have the Government adopt the centrigrade instead of the Fahrenheit scale.

Dr. Babcock called the attention of the Association at this time to a Bill introduced by Senator Works, of California, before the Committee of Public Health and National Quarantine to the effect that no Federal employee shall hereafter be a member of any medical organization, whether national, State, or civic, this evidently aiming at General Rupert Blue, as well as our own members who are officers in the medical service of the United States. At the meeting of the Chicago Tuberculosis Institute this matter was taken up. A telegram was sent to the Committee opposing the Bill, and it was decided that all members of the Society in Chicago should send letters to the members

of Congress from their district opposing it. Dr. Babcock felt that this is a matter of great importance, and thought that medical men should go on record, individually and collectively, as opposing any such pernicious measure as that introduced by Senator Works. He made a motion that the Secretary of this Association be directed to prepare a formal protest against this Bill, which shall have the signature of the President, and which shall be forwarded in the name of the Association, protesting against the passage of this Bill.

It was stated that the Massachusetts League for the Study and Control of Tuberculosis has already forwarded a protest against the Bill.

Dr. J. D. Thomas suggested that each member of the Association communicate with his congressman and senator protesting against the Bill, which would have a far greater effect and do a great deal more good. He offered this as an amendment to Dr. Babcock's motion.

Dr. Babcock said he made the motion that the protest be sent now because time is an important factor. This protest in the name of the Association might be followed by personal letters, however, with which plan he was in hearty accord.

Dr. W. F. R. Phillips said that Dr. Thomas's amendment is not exactly what we want. We want to place this Association itself on record as opposing the Bill. If the motion be amended it should be done, I think, by adding the words, "and that each member of the Association be instructed to communicate with the senator and representatives protesting against the passage of this Bill."

Dr. Thomas suggested that members be asked to communicate with their individual congressmen and representatives in whatever way may be best, as an addition or amendment.

The Chairman: It will go on record that Dr. Thomas's amendment is further amended by adding the words, "and that each member of the Association write, &c."

The Bill was stated to be in the hands of the Senate Committee on Public Health and National Quarantine—Hon. Joseph S. Ramsdell.

After the adjournment of the morning Session the Association was entertained at luncheon by Dr. and Mrs. Charles W. Richardson at their residence. The annual dinner of the Association was held in the evening.

Secretary and Treasurer's Report.

During the past year the following members have died: Dr. E. L. Trudeau, an honorary member, at Saranac Lake, November 13, 1915; Dr. John H. Huddleston, an active member since 1905, at New York City, October 30, 1915; Dr. John O. Roe, an active member since 1892, at his home in Rochester, New York, December 24, 1915; Dr. A. Alexander Smith, an active member since 1890, at his home in New York, December 13, 1915; Dr. George D. Kahlo, an active member since 1910, died at Old Point Comport, February 11, 1916; Dr. Henry L. Elsner, an active member since 1892, who died at Washington, D.C., February 17, 1916. None have resigned; one has been dropped.

Financial Statement.

There has been received during the past year from members in payment of dues $1,126, and there has been expended $674.14, leaving a balance, May 2, 1916, of $451.86. Our bills for printing, transactions, programmes, &c., will probably reach $500, but as yet they have not been received. Unpaid dues amount to about $190.

All medical societies publishing *Transactions* are confronted with greatly increased charges due to the extraordinary advance in the price of printing materials, not to speak of labour.

A circular letter has been received relating to a Bill introduced into the House of Representatives by Mr. Albert Johnson, of the State of Washington, having for its object the use of the Centigrade scale of temperature in all U.S. Government publications and the ultimate elimination of the Fahrenheit scale. We are specially requested to send expressions of opinion to the Thermometer Committee of the A.A.A.S., Bureau of Standards, Washington, D.C.

Report of the Twelfth Annual Conference of the Council on Medical Education and the Council on Health and Public Instruction of the American Medical Association.

Held in Chicago, February 7 and 8, 1916.

These meetings, as you know, are not for the purpose of presenting papers on various medical subjects, but rather for

the purpose of outlining working plans for the advancement of certain important problems.

Of the two days, one was devoted to the discussion of medical education (under the Council on Medical Education), the other to the discussion of public health (under the Council on Health and Public Instruction).

On the first day of this 1916 meeting, Dr. Arthur Dean Bevan, Chairman of the Council on Medical Education, outlined the advance in medical education in the United States during the past twelve years. Dr. N. P. Colwell, Secretary of the Council on Medical Education, reviewed the progress in medical education since 1865.

A symposium on "The Relation of the Laboratory Courses to the Work of the Clinical Years of Teaching" was presented by Dr. E. P. Lyon, University of Minnesota; Dr. Lewellys F. Barker, Johns Hopkins University; and Dr. James Ewing and Dr. Frederic S. Lee, both of Columbia University, New York City.

The entire programme was most instructive.

There was a joint Session of the Council on Medical Education and the Federation of State Medical Boards of the United States, at which a symposium on the National Board of Medical Examiners was presented. Dr. William L. Rodman, President of the Association, led in this symposium with an introductory statement. Surgeon-General William C. Gorgas presented the relationship of the United States Army to such a Board. Surgeon-General W. C. Braisted spoke for the Navy as relating to such an examining Board. Assistant-Surgeon-General John W. Kerr spoke for the United States Public Health Service in relation to such a Board. Dr. Herbert Harlan, President of the Maryland State Board of Medical Examiners, spoke on the relation of the State Medical Examining Board to such a National Board. Dr. Isadore Dyer, of New Orleans, presented the details of operation and examination for this National Board.

On the second day the State regulation of the practice of medicine was discussed, the subject being introduced by a very excellent address from Governor George H. Hodges, of Kansas. This address was followed up by papers: (1) "One Year's Experience with the New Law in Tenessee," by Professor Irby R. Hudson, of Nashville; (2) "What should be the Provisions of a Model Medical Practice Act?"

by Dr. Horace D. Arnold, of Boston; (3) "A Model Practice Act," by Dr. Walter L. Bierring, of Iowa; (4) "What should be the Provisions of a Model Medical Practice Act?" by Dr. W. J. Means, of Columbus, Ohio; (5) "Remarks on Model Medical Practice Act," by Dr. Royal S. Copeland, of New York.

Following these papers were reports from members of the National Legislative Committees of the various States.

Closing the programme were two papers, one by Dr. J. W. Kerr, Assistant-Surgeon-General of the United States Public Health Service, on "Some Essentials in the Development of Efficient Health Organization"; the other by Dr. Charles V. Chapin, Superintendent of Health, Providence, Rhode Island, on "State Health Organization." These two papers were of excellent quality, and should be carefully read by all those who are interested in the advancement of public health work and preventive medicine.

The entire programme was of excellent quality, and furnished groundwork for further improvement in matters pertaining to medical education and public health.

These papers and the discussions relating to same were published by the American Medical Association as two special bulletins, entitled "Educational Number" and "Public Health Number," No. 3, vol. ii, dated January 15, 1916. These bulletins can be secured by writing to the American Medical Association.

H. M. Bracken, M.D.,
Delegate.

Report of Delegates to the Second Pan-American Scientific Congress.

The first Pan-American Conference of any sort was held in Washington in 1889-1890, with an adjourned Session in Philadelphia. The first regularly organized Pan-American Scientific Congress was held in Chile in 1908-09. The second, which met in Washington, December 27, 1915, to January 8, 1916, under the auspices of the Department of State, is the one of which I have the honour to make a report. The next, or third Congress, will be held in Lima, Peru, in 1921.

The recent Congress was a huge affair, and was undoubtedly a magnificent success. Great credit is due to the State Department and to Mr. John Barrett and Dr. Glen Levin Swiggett for the organization, the arrangement of the scientific programmes, and the social features of the meeting. There were over one thousand delegates representing twenty-one American republics, and at the brilliant reception given by the President of the United States in the White House there were over four thousand guests. Although a scientific Congress, it covered the broad field of Pan-Americanism, and served to knit together all the nations that participated, inducing a better understanding of their aims, and fostering a true brotherly spirit the influence of which can scarcely be over-estimated.

The enthusiasm and applause which marked the notable and patriotic passages in the President's address at the Pan-American Union was a real inspiration, and was re-echoed when His Excellency the Ambassador from Chile, Sr. Mujica, translated its principal points into Spanish for the benefit of the South and Central American delegates.

In the eight sections many of the papers were read in Spanish or French, and if it had not been for the liberal use of collateral translations in the admirable system of section programmes and printed literature, the Americans present would have lost much of the valuable proceedings.

As it turned out, many of the delegates from distant lands understood and spoke English well. The criticism has been made that the South American has a right to and does wonder why we do not meet him half-way in this matter of language if we expect to have relations with him. He is quite willing to excuse the older men, but not at all the younger men, who claim to be cultured, want to have relations with Spanish-Americans, and yet are unwilling to make any attempt to learn the Spanish language, which, after all, is the foundation-stone of a real structure of sympathy. It is right here that our colleges and schools have a vital problem to solve.

There were nine Sections in the Congress, and the official languages were English, Spanish, and French.

In Section II, devoted to Astronomy, Meteorology, and Seismology, it was interesting to note that Argentina has a thoroughly equipped Weather Bureau, issuing a daily

weather map, and under the direction of a man thoroughly trained in our own Weather Bureau, and at Blue Hill Observatory.

Publications of interest in English and Spanish were prepared for this Congress, giving an account of each country participating. These were will illustrated and full of information; especially notable were the exhibits thus made by Argentina, Brazil, Uraguay, Paraguay, Peru, and Cuba.

One interesting accomplishment, unique as far as we know, may be credited to Brazil. It is a fine example of medicine, co-operating with the agriculturist. Brazil is infested with serpents, many of them venomous; others, like the boa-constrictor and mussurana, devoid of venom. The deaths from venomous serpents in Brazil are about 4,800 yearly, and the probable number of accidents is nearly 20,000.

Brazil is essentially agricultural, and the unfortunate victims are the young and vigorous labourers in the fields and in the tropical forests. The vital and economic loss each year is alone sufficient to enlist the sympathy of the State and the best aid that medical science can afford.

The unique institution of which Brazil can well boast is the Institut de Butañtañ or the Institut Sérumthérapique de São Paulo. For twelve years its products have been at the disposal of Brazilian physicians for the cure of venomous snake-bite, and its successful experience is well portrayed in Dr. Vital Brazil's work, "La Defense contre L'Ophidisme," copies of which were brought to the recent Congress.[1]

The Institut de Butañtañ is provided with serpentaria, or parks for serpents. These are enclosed with solid concrete walls, 5 ft. high, surmounted by an iron railing. Just inside the wall is a canal or moat a yard wide. The inner space is subdivided by walls for different species of snakes, and for their accommodation in the larger park, covering about 500 square yards, there are twenty-five concrete huts, dome-shaped, and arranged in geometrical design. Plots of grass, the care of which, we imagine, would be somewhat hazardous, justify the name of park.

The water in the canals affords a natural habitat for some species of snakes, and they find there frogs and fish for food. One of these parks is reserved for non-venomous serpents,

[1] Pocai Weiss and Co., Sao Paulo, 1914.

such as the mussurana. This snake does not hesitate to attack and feed on the poisonous ones, no matter how deadly these may be for other animals. They are very skilful in this combat, the venomous serpent evidently relying on his fangs to win the day, as they always do with every other foe. But the mussurana strangles his victim and proceeds calmly to devour him.

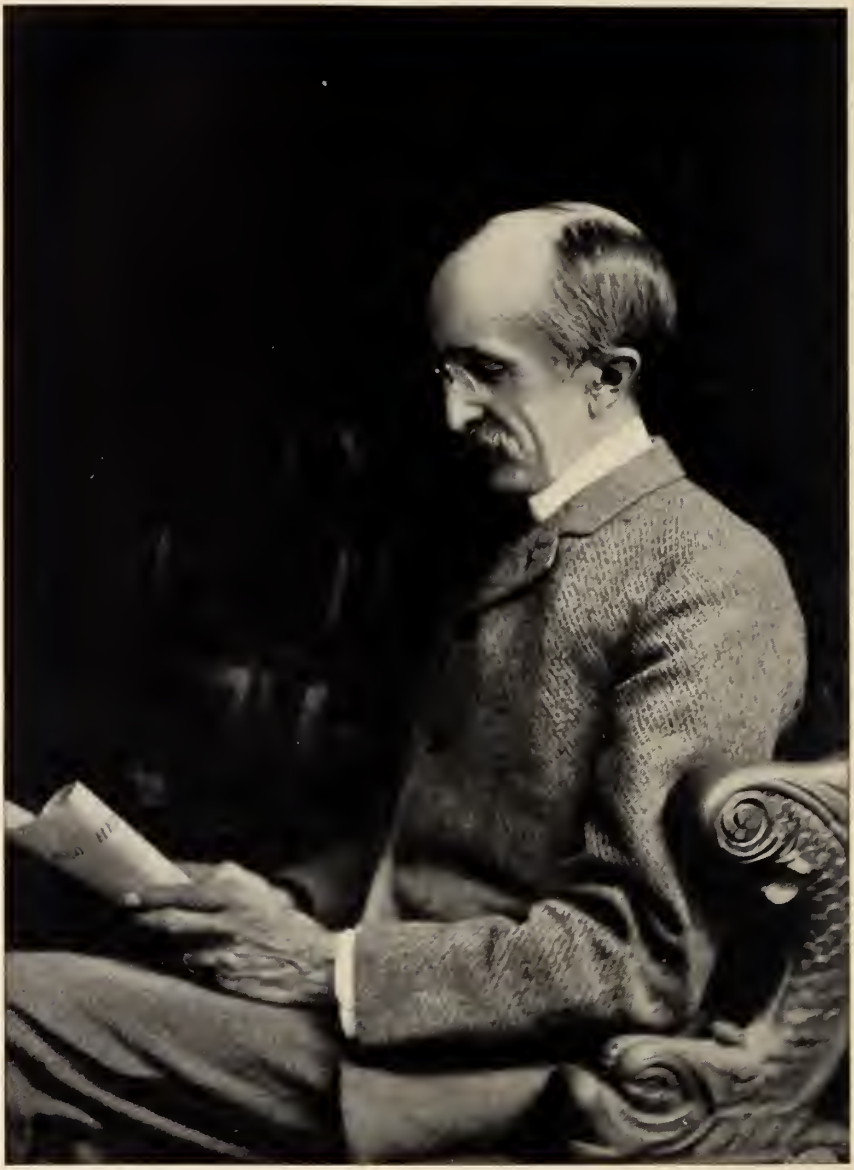
Thus it is that the mussurana is destined to play an important part in defending the natives against loss of life from the more dangerous varieties. The institute declares that this snake should be rigorously protected by the rural population, who should be informed of these facts, and it should be absolutely forbidden to kill them under penalty. It is a fact not uncommonly noted at the institute that a mussurana can kill and swallow a venomous serpent of larger size than himself, strange as this may seem.

At its inception in 1901 the institute undertook the production of a serum for treating bubonic plague, and later included the preparation of antitoxin for diphtheria, antitetanic serum, tuberculins, and four specific serums against snake poison. These are known as anti-crotalic, anti-bothropic, anti-elapinic, and anti-ophidic serums. The first is derived from animals hyper-immunized against the venom of *Crotalus terrificus,* the only species of rattlesnake found in South America. The anti-bothropic is derived from animals immunized against the venom of the commoner species of Lachesis, such as jararaca (*Lachesis lanceolatus*), uruti, or coatiara (*Lachesis alternatus*), and *Lachesis atrox*. The anti-elapinic serum is derived from animals immunized against the venom of the Elaps, to which the brilliant coral snake belongs. The fourth, or anti-ophidic, is a polyvalent serum, and to produce it animals must be immunized against a mixture of venoms of various proportions.

The entire work is based on the production of immunity in animals and the withdrawal of serum from them for combating the effects of the corresponding venom in man. Thus it is that the lower animals serve to protect and save human life. Every army to-day has its supply of anti-tetanic serum, and it is of inestimable value in the present European War. The peaceful army of agriculturists in Brazil is provided with a serum against the deadliest forms of snake poison, and there is no treaty of peace to look forward to in that conflict.

The institute has endeavoured to combat the ignorance, false ideas, and superstition of the people by means of publications, experimental demonstrations, and conferences. It also has organized a system of exchange, by which serum and syringes are sent in exchange for serpents, which are forwarded from the interior. For each serpent sent in a tube of serum is given in return, and for six serpents a syringe for its use. Physicians can be supplied with a noose for capturing snakes, boxes, and railroad tickets for their transportation to the institute. The railroads furnish the tickets free of charge.

GUY HINSDALE.



E. L. Trudeau

IN MEMORIAM.

Dr. EDWARD LIVINGSTON TRUDEAU.

In the death of Dr. Edward Livingston Trudeau, the Climatological and Clinical Association has lost its most noted and beloved member.

His place in the medical profession of America was unique. As the pioneer in the sanatorium treatment of tuberculosis he became the acknowledged leader in the entire anti-tuberculosis campaign. His original researches established his fame as a scientist; as a clinician, his rare skill in the practice of medicine and wonderful appreciation of human character and human needs commanded the universal respect and confidence of colleagues and patients alike; his brave struggle and ultimate triumph against the overwhelming odds of impaired health and adverse circumstance kindled the admiration of even the cold outside world.

But more even than all this, it was the rare spirit and wonderful personality of the man himself which gripped to him with the bonds of deep affection a host of devoted friends all over this broad land.

In the endeavour to do fitting honour to the memory of such a man, no small group, however close to him, may claim too great a share.

The members of the Climatological Association, however, were his warm, personal friends, and from the similarity of their activities and interests are especially well qualified to appreciate the achievements of his life. It is therefore peculiarly fitting that we record our tribute to his memory in the same spirit that we delighted to do him honour when he was still with us.

Dr. Trudeau became a member of our Association in 1885. He was its Vice-President from 1891 to 1894, and since his retirement from active membership in 1896 his name has been upon our roll of Honorary Members.

During the earlier periods of his medical career he was much interested and very active in all of the concerns of the Association, and contributed not a few of his medical researches to the medical profession first through the meetings of this Society. His very first scientific paper was presented at the meeting of the Climatological Association at Baltimore in 1887, and this was also his first public appearance before a medical audience. The title of this paper was "Environment in its Relation to the Progress of Bacterial Invasion in Tuberculosis," and presented experimental evidence in support of the value of open-air treatment of tuberculosis which has never been excelled, and this study now stands as one of our medical classics.

His own personal experience upon this occasion was so remarkably characteristic of the man and so incongruously at variance with the scientific importance of his contribution, that it seems proper to record it here as it is charmingly told in his own words in his recently published autobiography. He writes as follows:—

"In the winter I wrote the paper which was entitled 'Environment in its Relation to the Progress of Bacterial Invasion in Tuberculosis,' and we went to town in May, so that I might be present at the meeting of the Climatological Association.

"I left my wife and children in New York, and went down on the afternoon train to Baltimore with Dr. Loomis. It was the beginning of June, and terribly hot when we reached Baltimore that evening. I hardly slept at all that night. I do not think this was entirely due to the heat, however, as I was beginning to dread the idea of speaking in public before a large audience of doctors, and I am sure this kept me awake. The next day it was just as hot, and I could eat no breakfast. I went to the meeting and found a large hall packed with medical men. I sat next to Dr. Loomis and listened to the papers on the programme, but it seemed a long session, and the dread of having to speak before such an audience increased.

"It was almost time for my paper, when I began to feel dizzy and faint. I leaned over to Dr. Loomis and said, 'Doctor, I feel badly.' He turned around and looked at me, and said, 'Get up and go out.' I tried to, but just before I got to the door darkness overtook me and I fainted. The

next thing I remember I was lying on the floor in the hall just outside of the meeting-room, and I could hear the hum of voices. Dr. Loomis was leaning over me and saying, 'Where is your paper?' I gave it to him, and then lay there in a sort of half-conscious state, listening to Dr. Loomis's strong voice as he read my paper. Then came loud applause, and soon Dr. Loomis came back and handed me the paper, and said, 'That was a good paper.' Other men crowded around me and shook hands with me and spoke of the paper, and hoped I was feeling all right again. I got on my feet and walked out into the street, while somebody held my arm, and I soon began to feel much better.

"That was my first experience at a medical meeting and the way I read my first paper. I was thoroughly ashamed of myself, but there was no help for what had happened, and I tried to lay my fainting entirely to the excessive heat. I found some comfort, however, later in the fact that my paper was noticed by many of the medical journals in this country, and that abstracts of it appeared in two or three of the well-known medical publications abroad.

"When I got back to New York that night I vowed I would never go to a medical meeting again, but I have done so, nevertheless, on very many occasions. I was a long time overcoming my stage-fright when speaking in public, and I am not so sure that I have quite done so yet.

"The last time I spoke in public was in strange contrast to my first experience. In May, 1910, I delivered the Presidential Address in Washington at the Congress of American Physicians and Surgeons, and although I was very ill and miserable with fever and had to get out of bed to do it, the warmth of the reception accorded me by my professional brethren from all over the United States so overwhelmed me that I was not at all aware of any nervousness, and have looked back on that evening as one of the red-letter experiences in my life."

Even were it possible, it is not needful to recount to this company of his friends all that Dr. Trudeau's life has meant to us personally and to our Association, to the medical profession as a whole, and to humanity in general. His memory is indelibly recorded in our hearts far beyond our power to express. This occasion when we meet to do him honour offers, however, to us who are left to carry on the

work which he began, a fitting opportunity to consecrate our efforts anew to the ideals which inspired and governed his life. May his influence be recorded in our lives by emulation of his wonderful bravery in the face of every handicap and discouragement, of his keen pursuit of scientific truth, of his deep sympathy with the trials of human nature under the stress and strain of physical suffering, and, above all, of his strong Christian faith and character, which made him a tower of strength in the presence of cruel disease, both within and about him.

May our lives and our efforts be the better and nobler because of his, which have gone before us, thus, and thus only, can we fittingly do honour to his memory.

James Alexander Miller.

Dr. A. Alexander Smith.

Dr. A. Alexander Smith died suddenly at his home in New York City on December 13, 1915. Though he had had some premonitory symptoms of a weakened heart, he continued in active work up to the day and hour of his death.

Dr. Smith was the son of James Alexander and Mary Ann Corbin Smith, and was born at Wantage, New Jersey, on March 25, 1847. In 1868 he graduated at Lafayette College with the degree of A.B. He at once entered upon the study of Medicine at the Bellevue Hospital Medical College, and received his degree of M.D. in 1871. During the following year he served as interne on the house staff of Bellevue Hospital. On finishing his service in the hospital he began the practice of medicine in New York, and continued in active practice up to the time of his death. Dr. Smith was connected with a number of New York hospitals, but his chief service was rendered in Bellevue Hospital, in which he held the place of Visiting Physician from 1882 to the time of his death, a period of thirty-four years. In 1875 he was appointed Adjunct Lecturer in Clinical Medicine in the Bellevue Hospital Medical College. In 1880 he became Professor of Medicine in the same institution, and in 1898 he was chosen Professor of the Principles and Practice of Medicine and Clinical Medicine

DR. A. ALEXANDER SMITH

"To the Editor of the *Evening Post*:—

"Sir,—To a very large number of people Dr. A. A. Smith's death will come as a real sorrow. In his profession he was pre-eminent. To his patients he was the all-round, well-equipped, general practitioner, who had seen much of disease, and could be relied upon to give the best advice. Then, too, he had a heart that was devoted and true. With him there was never a lack of genuine human sympathy. To his friends in and outside the profession Dr. Smith was all a man should be—loyal, true, outspoken, reliable.

"He was a prominent figure in the best medical societies, and whatever he said in discussions was always worth listening to, because it rested upon wide experience. His career as Professor of Medicine at the University Bellevue Hospital Medical College during many years was of great service to the younger medical men, because Dr. Smith taught with singular clearness and force, and, moreover, he had had the best preceptors, like Flint, sen., Barker, and Janeway.

"He is gone, and there are very few left now in New York City who started in the race with him and who still keep their activity in mind and body. There are few, indeed, who show us such an honoured past, by all the tests that true men consider fine, as did Dr. A. A. Smith.

"Beverley Robinson.

New York, December 15."

This noble and characteristic letter of Beverley Robinson was closely followed by the second:—

"To the Editor of the *Evening Post*:—

"Sir,—Will you allow the writer to add a few words to the admirable letter of Dr. Beverley Robinson, published in your columns to-day, in memory of the late Dr. A. A. Smith, in whose praise not enough has been said, and too much could scarcely be said?

"Not only was he a type of the all-round, well-equipped general practitioner, but he was a wise, calm, and a modest, kindly gentleman, to whom distinction came not through his own seeking, but as the natural result of solid achievement. His was a beautiful life—a life of industry and of benefaction. For more than forty years he went unassumingly upon his daily rounds in this city, carrying help and comfort to thousands; and when he passed away, it was as he would have wished to go—with every faculty unimpaired, and at the height of his career.

DR. HENRY LEOPOLD ELSNER.

Syracuse, New York.

Born August 15, 1857. Died February 17, 1916.

"When he entered the sick room or the strickened family a sense of steadiness and hopefulness went with him, a consciousness that the best which could be done would be done. His life and character should be held up to the younger members of his profession as a fine example to be followed, and may we not hope that somewhere in this city, where he laboured so long, some fitting memorial may appear to commemorate the life and work of the true, devoted, conscientious physician, Dr. A. Alexander Smith?

"A Grateful Friend.

New York, December 17."

These two letters, which honour the writers as much as their subject, deserve to be recorded in the annals of this Association.

J. W. Brannan.

Dr. HENRY L. ELSNER.

Dr. Henry L. Elsner, Fellow of the American Climatological and Clinical Association, died suddenly in Washington, D.C., February 17, 1916. He had for some time known of the existence of a serious cardio-vascular condition that caused apprehension amongst his most intimate friends. It was this condition which determined his fate, after contracting an ordinary bronchial cold. He had gone to Washington for rest and recuperation after a winter of arduous work. Dr. Elsner was born in Syracuse, N.Y., August 16, 1857. His father was a physician, an older brother had entered the profession, and to it he was always attracted. His preliminary education was acquired in the public schools of his native city. After graduating from the High Schools, he entered the College of Physicians and Surgeons, now the medical department of Columbia University, and received the degree of M.D. from that college in the spring of 1877 before he was 20 years old. At that time the medical faculty of the University of Vienna was exceptionally strong, and to it the young doctor journeyed in the autumn of 1877 for post-graduate work. He selected the courses that should make him familiar with the diagnosis and treatment of internal diseases. After leaving Vienna he visited other medical centres, and walked the

hospitals with the leaders of medical practice until his return to his native city in the fall of 1879. This careful study of the methods of the foremost medical men of Europe gave him an advantage which was early recognized by his *confrères* in Syracuse. In 1882 he was elected Instructor of Medicine in the College of Medicine of Syracuse University, and was advanced with unusual rapidity, until in 1893, upon the resignation of Dr. H. D. Didima, also a Fellow of the American Climatological Association, he was elected full Professor of the Science and Art of Medicine. His teaching career, begun thus early, continued, interrupted only by successive journeys to the centres of medicine in Europe, up to the time of his death.

In 1881 Dr. Elsner married Pauline Rosenberg, of Rochester, N.Y., a lady of great personal beauty and charm, of high character, and of unusual mental brilliancy. She was his constant inspiration and his comrade through all his life, and to her he was proud to attribute much of his success. Their life of closest companionship ended almost simultaneously. Mrs. Elsner had been for some years an invalid, but she never gave up her position at his side. She was with him in Washington, cared for him in his brief illness, nerved herself to bear the shock of his death, carried out all the arrangements for the final obsequies, followed his body to the tomb, and then collapsed, went into coma, and died in the early hours of February 23, hardly more than five days after the death of her husband.

Dr. Elsner's ability received merited recognition by the various medical societies of which he became a member, and he was elected President in succession of the Onondaga Medical Society, the Syracuse Academy of Medicine, the Central New York Medical Society, and the New York State Medical Society. He was largely instrumental in bringing about the amalgamation of the New York State Medical Society and the New York State Medical Association. He was elected a delegate to the American Medical Association, and served on the Education Committee of that Association for several years. He became a Fellow of the American Climatological Association in 1892, and contributed to its programmes and to its discussions.

Dr. Elsner was easily the most popular man in the medical profession in Central New York. His genial

manner, the warmth of his friendships, the earnestness with which he presented his observations, all contributed to draw to him an increasing *clientèle,* not only amongst people of ability, but amongst the profession at large, so that for many years he had enjoyed an extensive consultation practice and had become well known, and had intimate friends amongst the best men in the profession of this country and of Europe. Syracuse University conferred upon him the degree of LL.D. in 1915.

The teachers and students of Syracuse recognized in him a man of high ideals, of indefatigable energy, an inspirational teacher, and a friend always ready to be helpful.

His contributions to current medical literature were very many. The most notable of his shorter works was the article on pneumonia in Forcheimer's "Therapeusis of Internal Diseases." During the last two years of his life he had been engaged in writing, and had completed a large volume on prognosis for "Monographic Medicine," which is just about to be issued by the Appletons. This is a volume of twelve hundred pages, and is a complete treatise on internal medicine, with special reference to the science of prognosis, and is the first complete work on this aspect of medicine to appear in English. It is a worthy companion to Dr. Lewellys F. Barker's work on "Clinical Diagnosis," Dr. M. Howard Fussell's "Differential Diagnosis," and Dr. Albion W. Hewlett's "Special Pathology," which four works together make up this notable publication.

John L. Heffron.

Syracuse, N.Y.,
May 8, 1916.

Dr. GEORGE DWIGHT KAHLO.

Dr. George Dwight Kahlo, a member of the Association since 1910, died on February 12, 1916, at Old Point Comfort, Virginia, of cerebral hæmorrhage. Dr. Kahlo was in his fifty-first year. He was graduated from Bellevue Hospital Medical College, 1891; a Fellow of the American Medical Association; President of the Indiana State Medical Association in 1909; Secretary to the United States Consul at Sydney, Australia, in 1881; for several years Professor

of Practice of Medicine and Dean of the Central College of Physicians and Surgeons, Indianapolis; and later Professor of Clinical Medicine in the Indiana University School of Medicine; from 1908 to 1912 Medical Director of the French Lick Springs Sanatorium, and since that time Medical Director of White Sulphur Springs, W. Va.

W. E. CASSELBERRY, M.D.

William Evans Casselberry will be remembered by his friends as a man of medium height, rather slender build, with black hair, and brown eyes. He was full of energy, always at work, or rarely diverted from his professional work even for recreation. He will be remembered as a fluent, earnest, exact, and full speaker, often also as an eloquent one. As a writer he was clear, accurate, and painstaking. He was a clever draughtsman, and made the many illustrations which accompanied his numerous contributions to medical literature.

While at work with patients he permitted no diversions of conversation to interrupt the concentrated attention which he gave them. He was most thorough and painstaking in his examinations and treatment. His private practice was a large one. He devoted the forenoon hours to new patients and routine treatment of old ones, and the afternoon to operating.

Dr. Casselberry took a most active interest in his specialty of nose, throat, and ear disease, but also continued deeply interested in diseases of the lungs. He contributed annually articles of merit to the national and local laryngological societies. Unfortunately, ill-health many years ago interrupted the completion of a book which he had partly written upon his specialty.

Dr. Casselberry's family has resided in or near Philadelphia since colonial times. His grandmother was a Rush of the family of Dr. Benjamin Rush.

Dr. Casselberry graduated as Doctor of Medicine from the University of Pennsylvania in 1879, and served as Resident Physician and Surgeon in Germantown Hospital. When he left that institution he went for post-graduate

W E. CASSELBERRY, M.D.

Born September 6, 1858. Died July 11, 1916.

work to Vienna, Berlin, also London. In the last city he worked with Sir Morell Mackenzie. On his return to this country he settled in Chicago, where he lived until his death.

In 1883 he became Professor of Materia Medica and Therapeutics in North-western University Medical School. This chair he held until 1894. He also conducted out-patient clinics in the throat and chest department of the South Side Free Dispensary. In 1894 he was made Professor of Laryngology and Rhinology in the same school, and began the development of a clinical service which soon became a large and valuable one for teaching purposes. Much earlier he limited his private practice to this specialty. For many years he had been attending laryngologist and rhinologist to St. Luke's Hospital.

Dr. Casselberry was a Fellow of the American Medical Association, and formerly Chairman of the section of Laryngology and Otology. He was an active member of the American Laryngological Society and one of its former Presidents. He was a member of the American Academy of Ophthalmology and Oto-Laryngology, American Clinical and Climatological Association, of the Illinois State Medical Society, the Chicago Medical Society, Chicago Laryngological Society, Chicago Academy of Sciences, Chicago Tuberculosis Institute, National Association for the Study and Prevention of Tuberculosis, the Physicians' Club of Chicago, and Fellow of the American College of Surgeons. He also took an active part in the meetings of the IXth International Medical Congress, which convened in Washington in 1887. Of social and non-professional organizations, he was a member of the University Club of Chicago and of the Onwentsia Golf Club of Lake Forest.

Dr. Casselberry suffered from a hemiplegia in December, 1915, which incapacitated him for work. He was, however, slowly improving until July 10, 1916, when he was seized with an attack of angina pectoris, which, recurring the following day, caused his death. He died at his summer home in Lake Forest. He is survived by his wife, a daughter, and two sons, also by his father and sister.

Dr. William Evans Casselberry was born in Philadelphia, September 6, 1858; died July 11, 1916.

He was the son of Jacob Rush Casselberry and Ellen Lane Evans. His father was a merchant in Philadelphia,

born in Evansburg, Montgomery County, Pa., August 20, 1832. He is still living in New York City.

Dr. Casselberry's mother was born July 3, 1830; she died in 1867. His grandfather was Isaac Casselberry, born 1803, died 1874. His great-grandfather was Benjamin Casselberry, born 1771, died 1842.

Dr. Casselberry married Lilian Hibbard on June 23, 1891.

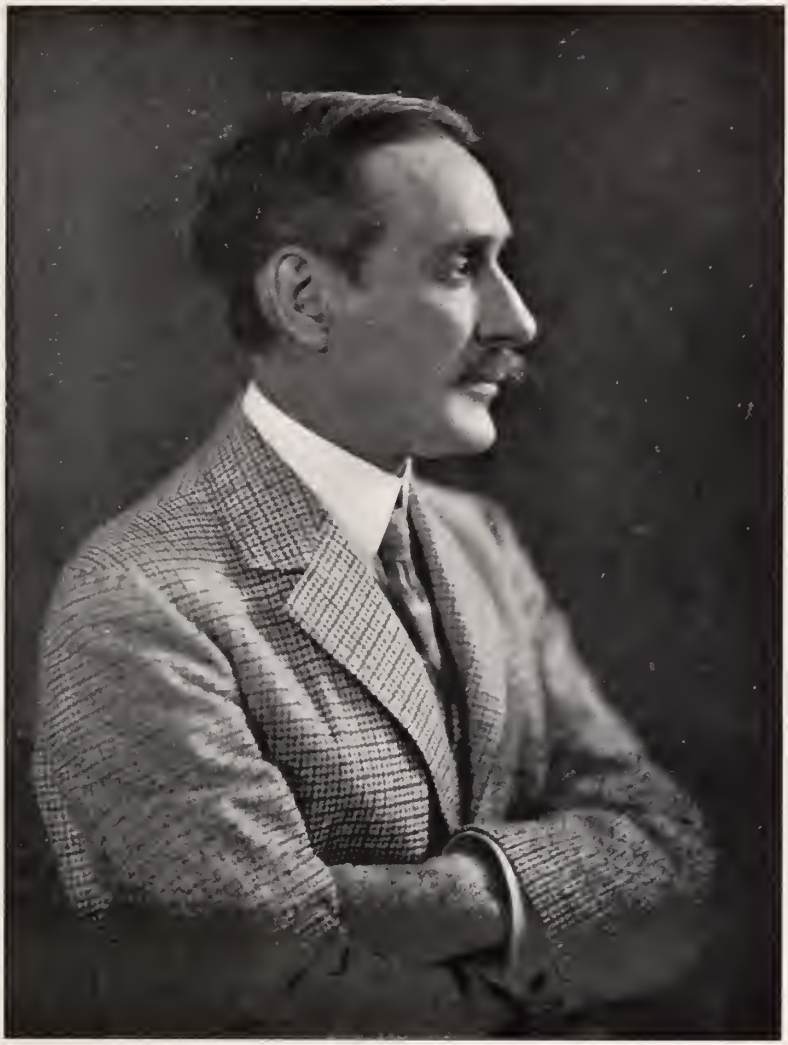
Dr. D. BRADEN KYLE.

Dr. D. Braden Kyle, of Philadelphia, one of America's foremost authorities on diseases of the nose, ear, and throat, died on October 23 from pleuro-pneumonia, after an illness of only four days. It is probable that he was a martyr to his profession, as he was in such buoyant health on his return from California on September 15, that his associates think he must have contracted pneumonia while treating a patient with an infected throat.

Throughout a successful medical career, Dr. Kyle has done much to disseminate knowledge and to promote the efficiency of specialists and general practitioners. His text-book on "Diseases of the Nose and Throat" first appeared in 1899, since when four more editions have been published. In Hare's "System of Therapeutics" (1897) he contributed a chapter on "Diseases of the Uvula, Pharynx, and Larynx," and in the "American Year Book of Medicine and Surgery and American Medicine" he was the editor of the chapters on the nose, throat, and ear.

Other articles he has written include "Treatment of Hay Fever by means of Cocaine Phenate" (1892); "The Antiseptic Properties of the Oil of Cinnamon" (1894); "Diphtheria, Etiology, Pathology, Diagnosis and Treatment, especially Serum Therapy, Nasal Hydorrhœa" (1896); "Nasal Bacteria, the Relation they bear to Disease" (1899); "The use of Suprarenal Gland in Diseases of the Nose and Throat" (1902); and "The Chemistry of Saliva in Relation to Hay Fever" (1907). He also invented several instruments which are now extensively used in his specialities.

Dr. Kyle was born at Cadiz, Ohio, October 11, 1863, the youngest son of Samuel W. Kyle, whose family was one



Dr D. BRADEN KYLE.

Born October 11, 1863. Died October 23, 1916.

of the oldest in the State, coming originally from Kyle, in Ayrshire, and descended from James Kyle, first Vicar Apostolic of Scotland. His mother was of English extraction, being a lineal descendant of Thomas Cross, who came to this country in 1746, and served under Washington in the Revolution.

Dr. Kyle was married December 19, 1900, to Miss Jeanette E. Smith, daughter of the late Colonel Thomas J. Smith, of Philadelphia.

His early education was received in a private school. After his graduation from Muskingum College he entered Jefferson Medical College, also studying bacteriology and pathology privately with Professor W. M. L. Coplin, and nervous diseases, anatomy, and surgery with Professor J. Chalmers Da Costa. Throughout his senior year he was an office student of surgery with Professor W. Joseph Hearn, and on his graduation was awarded a gold medal for an essay on "The Pathology and Treatment of Tetanus."

The autumn after his graduation he was appointed to the chair of Pathology, which he filled for a year. Meanwhile he had begun to practice in Philadelphia, and established a private laboratory for work and instruction in clinical microscopy, bacteriology, and pathology, giving a regular course of three years. In 1894 Professor Da Costa became associated with him, and surgery was added. The laboratory soon grew to such an extent as to demand more time than could be devoted to it, so in 1896 the course was discontinued, and Dr. Kyle concentrated his energies on investigations in his own private laboratory. In 1896 he was elected Professor of Larynology in his old college, which position he held until the time of his death.

From 1891 to 1893 he was Chief Laryngologist, Rhinologist, and Otologist to St. Mary's Hospital, and in the latter year was elected to a similar position in St. Agnes's Hospital.

In 1906 Dickinson College conferred on Dr. Kyle the honorary degree of Master of Arts.

His opinions are largely accepted as authority in the field of his specialty by members of the profession, his eminent standing being indicated in the fact that in 1900 he was President of the American Laryngological, Rhinological, and Otological Society, which met in Philadelphia. Two

years later he was chosen Vice-President of the American Laryngological Association, which met in Boston, and in 1911 he was elected to its presidency.

Dr. Kyle was a great traveller. Every summer he took long vacations, and with Mrs. Kyle frequently hunted big game in the Rocky Mountains. He knew well the silent places of Colorado, Wyoming, Montana, and British Columbia, and there renewed his strength for the strenuous work of the following winter.

Dr. Kyle was one of the most industrious men in his profession. No effort to cure or save a patient was too great for him to make. He knew no distinction in class or sect, and only differentiated between the rich and the poor to give greater attention to the latter. In spite of an enormous and lucrative private practice he never refused a charity case. He would give to the poor and the lowly the same careful attention, and contributed to them as freely from the same great skill as if he were attending the most wealthy or the most prominent families in the country. For his friends, to those of whom he was fond, he recognized no bounds as to time and labour. He was a devoted and loving friend, and for those whom he termed such, nothing was too much for him to undertake and accomplish.

He early taught that disease or inflammation of the throat or nose came from a systemic condition, which would yield readily to general treatment, but would be obdurate to simply local applications. He had a habit of operating as early as six or seven in the morning, so that he himself could watch his patient during the day. One of the secrets of his success was that he never left to his subordinates or assistants the care of a patient after an operation. He has been known to travel miles in the country in the middle of the night to take care of his patients.

Little children particularly appealed to him, and he had an unusual attraction for them. His sweet, kindly nature; his warm, friendly smile; his outgiving of love and affection endeared him to all his little patients. If one of these were ill, there was no trouble or burden too great for him to assume.

With his passing to the great Beyond there has been a loss to the community which cannot be filled. There will be other great physicians in his own branch of medicine, but

Dr. HARRY HUSTON WHITCOMB.

Born October 3, 1855. Died September 28, 1916.

the combination of a great and distinguished doctor, eminent author, famous teacher, and loving and unselfish friend, such as existed in Braden Kyle, cannot be found in many generations.

The world is the richer for having known him, even for the all too brief half century of his life; and the community in which he lived—his poor people and his friends, the little children who loved and depended upon him—will day by day and year by year appreciate the loss that they are called upon to sustain—a loss that will not grow lighter as the years roll on.

Dr. HARRY HUSTON WHITCOMB.

Dr. Harry Huston Whitcomb, the son of John and Harriet Huston Whitcomb, was born in Philadelphia October 3, 1855, and after an illness lasting several months died at Atlantic City, N.J., September 28, 1916. His life from early childhood was spent in Montgomery County, Pa., his parents having moved there from Philadelphia when he was a very small child.

On both his paternal and his maternal sides Dr. Whitcomb's ancestors were closely identified with the early history of the country. Two of his great-grandfathers, James Whitcomb and John Huston, fought in the Revolutionary War, John Huston as an officer, and his grandfather, John Huston, Jun., as an officer in the war of 1812. On his mother's side he was descended from the Jenkins family, the family of the founder of Jenkintown, Pa. His great-grandfather in this line came to America with Wm. Penn in his second expedition.

Dr. Whitcomb received his education in the public schools and at the Millersville Normal School. After two years spent in teaching, he entered the University of Penna, graduating therefrom in 1880. On the completion of his medical studies he left the country, near Center Square, Montgomery County, where he had made his home, and began the practice of medicine in Norristown, the county seat. His life thereafter was closely identified with Norristown and its institutions.

At the time of his death Dr. Whitcomb was Medical

Inspector for the county under Dr. Dixon, Commissioner of Health, an office he had held for a number of years. He was head of the Norristown Tuberculosis Dispensary, Consulting Physician for the State Hospital for the Insane at Norristown, and a Staff Physician for the Charity Hospital. During President Cleveland's first administration he was appointed a member of the Examining Board for Pensions, a position he retained until his death.

Dr. Whitcomb was Secretary of the Montgomery County Medical Society, a member of the Climatological Society, of the College of Physicians and Surgeons, and of the State and National Medical Societies. He was for twenty-one years Medical Examiner for the Prudential Insurance Company.

Before his seizure, on February 24, 1916, by his last illness, angina pectoris, Dr. Whitcomb had almost perfect health, never having been confined to bed by sickness for more than a day or two in his life. He rallied from this illness again and again, but the hopes roused for his recovery were doomed to disappointment, and he died at Dr. Marvel's private hospital at Atlantic City, September 28. He was buried in the family vault in Riverside Cemetery, Norristown, October 2.

Dr. Whitcomb became a member of the Climatological and Clinical Society in 1897.

CONSTITUTION AND BYE-LAWS.*

CONSTITUTION.

Article I.—Name.

This Society shall be known as the American Climatological and Clinical Association.

Article II.—Object.

The object of this Association shall be the Clinical Study of *Disease, especially of the Respiratory and Circulatory Organs, and of Climatology and Hydrology.*

Article III.—Membership.

Section 1.—This Association shall consist of *active, corresponding, Emeritus*, and *honorary* members, the former not to exceed 150 and the latter not to exceed twenty (20).

Section 2.—Names of candidates for active membership, whose applications shall have been endorsed by *three* (3) active members, shall be sent to the Secretary at or before the annual meeting at the second business session of which they shall be read and then lie over until the next annual meeting, when such as are approved by the Council shall be balloted on. Three (3) black balls shall be sufficient to reject a candidate. The Council shall have power to nominate active members.

Candidates for membership shall, at the discretion of the Council, present a paper to the Association showing clinical study of merit.

Section 3.—The power of nominating honorary and corresponding members shall be vested in the Council. The election shall be conducted in the same manner as that for active members. Honorary members shall enjoy all the privileges, but shall not be allowed to hold any office or cast any vote.

Section 4.—Anyone who has been an active member of this Association for twenty (20) years in good standing, and has attained the age of sixty (60) years, may become an Emeritus member by expressing his desire to do so, in writing to the

* As amended May 10, 1916.

Council, and he shall thereafter be exempt from all dues and duties of the Association.

Section 5.—Any member of the Association absent from the meetings, in person or by contributed paper, for three (3) consecutive years, without sufficient cause, shall be dropped from the list of members by vote of the Council.

Article IV.—Officers.

Section 1.—The officers of this Association shall consist of a *President,* two *Vice-Presidents,* a *Secretary and Treasurer,* and a *Recorder,* who, with the Delegate to the Executive Committee of the Congress of American Physicians and Surgeons or his alternate and five other members, shall constitute the *Council* of the Association.

Section 2.—Nominations. The officers, including the Council, shall be nominated by a committee of five (5) members, which committee shall be nominated by the President at the first session of each annual meeting and shall report at the business meeting.

Section 3.—*Elections.* The election of officers shall take place at the business meeting. A majority of votes cast shall constitute an election.

Section 4.—The President, Vice-Presidents, Secretary and Treasurer, and Recorder shall enter upon their duties at the close of the annual meeting at which they are elected, and shall hold office until the close of the next annual meeting, or until their successors are elected.

Section 5.—Members of the Council, other than the President, Vice-Presidents, Secretary and Treasurer, shall hold office for five (5) years.

Section 6.—Vacancies. Any vacancy occurring among the officers of the Association during the year may be filled by the Council.

Article V.—Duties of Officers.

President and Vice-Presidents.

Section 1.—The President and Vice-Presidents shall discharge the duties usually devolving upon such officers. The President shall be *ex-officio* Chairman of the Council.

Secretary and Treasurer.

Section 2.—As Secretary, he shall attend and keep a record of all the meetings of the Association and of the Council, of

which latter he shall be *ex-officio* Clerk. At each annual meeting he shall announce the names of all who have ceased to be members since the last report. He shall notify candidates of their election to membership. He shall send a preliminary notification of the annual meeting two (2) months previous thereto, and the programme for the annual meeting at least two (2) weeks previous to its assembly, to all the members of the Association. He shall also send notification of the meetings of the Council to the members thereof. At each annual meeting of the Association he shall read the minutes of the previous meeting and of all the meetings of the Council that have been held during the current year.

Section 3.—As Treasurer, he shall receive all moneys due, and pay all debts therewith. He shall render an account thereof at the annual meeting, at which time an auditing committee shall be appointed to report.

Recorder.

Section 4.—The Recorder shall secure the papers read and also proper notes of the discussions thereon and shall superintend, under the direction of the Council, the publication of the TRANSACTIONS.

ARTICLE VI.—COUNCIL.

The Council shall meet as often as the interests of the Association may require.

Four (4) members shall constitute a quorum.

It shall have the management of the affairs of the Association, subject to the action of the Association at its annual meetings.

It shall consider the claims of candidates recommended to it for admission to membership.

It shall not have the power to make the Association liable for any debts exceeding in total one hundred dollars ($100), in the course of any one year, unless specially authorized by a vote of the Association.

It shall have the entire control of the publications of the Association, with the power to reject such papers or discussions as it may deem best.

It shall have power to nominate active members at the annual meeting.

The Council shall have power to invite any gentleman, not a member, to read a paper at the annual meeting, on any subject within the scope of the objects of this Association.

The Council shall determine questions by vote, or—if demanded—by ballot, the President having a casting vote.

The Council shall constitute a Board of Trial for all offences against the Constitution and Bye-laws, or for unbecoming conduct, and shall have the sole power of moving the expulsion of any member.

The President, or any two members, may call a meeting, notice of which will be transmitted to every member two (2) weeks previous to the meeting.

Article VII.—Papers.

Section 1.—The titles of all papers to be read at any annual meeting shall be forwarded to the Secretary not later than one (1) month before the first day of the meeting, in order to appear on the printed programme.

Section 2.—No paper shall be read before the Association which has already been printed or been read before another body.

Article VIII.—Quorum.

A quorum for business purposes shall be ten (10) members.

Article IX.—Amendments.

This Constitution may be amended by a four-fifths ($\frac{4}{5}$) vote of all the members present at an annual meeting, provided that notice of the proposed amendment has been printed in the notification of the meeting at which the vote is to be taken.

BYE-LAWS.

(1) Meetings of the Association shall be held annually.

(2) The time and place of the meetings shall be determined by the Council.

(3) The dues of active members shall consist of an annual assessment not to exceed seven and a half ($7.50) dollars. Members in arrears shall not be entitled to vote. Those in arrears for two (2) years may be dropped from membership by recommendation of the Council.

(4) Order of business meeting.

First day:—

Calling the roll of members.

Minutes of previous meeting.

Secretary's and Treasurer's reports.
Recorder's report.
Report of Committee of Arrangements.
Appointment of auditing committee.
Appointment of nominating committee.
Report of Council on recommendations for membership.

Second day, Morning session: —

Reports of nominating committee and auditing committee.
Election of officers.
Election of members.
Nomination of candidates for membership.
Report of committee on health resorts.
Unfinished business.
Miscellaneous business.
Adjournment of business meeting

PRESIDENT'S ADDRESS.

SOME PHYSIOLOGICAL EFFECTS OF VARIOUS ATMOSPHERIC CONDITIONS.

By JAMES ALEXANDER MILLER, A.M., M.D.
NEW YORK.

Atmospheric environment is an interesting and important factor in many medical problems, in which no group of physicians is more directly interested than are the members of the American Climatological and Clinical Association, and, moreover, none in this country has contributed more than they to the advancement of this phase of medical knowledge.

It is for this reason, and also as a result of my own recent experience for three years in the work of the New York State Commission on Ventilation, that this topic has been chosen for presentation upon this occasion.

It is my purpose to approach the subject more from the physiological point of view in the hope that, by a consideration of certain fundamental principles, a clearer vision may be afforded of the problems involved in the effect which atmospheric conditions exert upon the comfort and efficiency of mankind, as well as of the *rôle* they may play in the causation, prevention, and treatment of disease.

The respiratory function of air focused the attention of

physiologists for generations—in fact, until very recent years. Consequently its effect upon the human body was interpreted solely in respiratory terms, and rules of hygiene were formulated upon this basis. Within doors inadequate ventilation was gauged in terms of deficient oxygen, or of excess of carbon dioxide, or later of the presence of certain volatile poisons in the air that was breathed. Out of doors, the general effect in health and disease produced by variations in climate or of its temporary representative, the weather, was also ascribed solely to their influence upon the air we breathe. To the truthful part of this hypothesis we all pay fitting tribute in the joy of the full deep breath and upon a fine crisp morning.

Under the lead of Pettenkofer [15], the CO_2 content of the air was for many years taken as the indicator of hygienic fitness, until Haldane showed that the alveolar CO_2 content of the air does not vary even when it is largely in excess in the atmospheric air, and he and others have demonstrated the lack of discomfort or other symptoms until the percentage of CO_2 reaches a point many times in excess of the range of possibility under any but experimental conditions. The same may be said of the effect of diminution of oxygen within any ordinary or probable limits.

In 1887 the researches of Brown-Séquard [3] claiming the existence of volatile organic poisons in expired air, and explaining the symptoms of exposure to vitiated air upon this basis, claimed wide attention. Although very recently Rosenau and Amoss [16] have reported the presence in expired air of substances which cause an anaphylactic reaction in animals, no other observers have been able to corroborate the results or conclusions of Brown-Séquard.

Other substances in the air, such as dust, bacteria, and odours, are recognized as playing a part in its hygienic

properties; but recent investigations appear to demonstrate that under ordinary conditions they are not factors of sufficient importance to affect health materially.

In general it may be accepted that the chemical or bacterial content of the air within any likely degree of variation is not of material moment, either hygienically or physiologically.

The retention of CO_2 determinations as a gauge of the amount of air-change in indoor conditions is the only remnant of the era of chemical standards for determining the hygienic condition of the air, and this gauge so used has no reference to the CO_2 content itself as an important physiological factor.

Researches of the past decade have all led to the appreciation of the physical, as opposed to the chemical features of the air as the important physiological factors. It is the reaction of the body to its environment through the skin surface rather than through the respiratory organs which is now recognized as of fundamental physiological importance. This may be expressed as the ventilating function of the skin, and the problems involved are largely those of the satisfactory heat regulation of the body.

Hermans [7], in 1883, was the first to call attention to this important fact, but it was the brilliant experiments of Paul [14] in Flügge's laboratory in 1905 that first riveted the attention of the scientific world upon this aspect of the problem. In cabinet experiment he adequately explained all of the symptoms caused by vitiated atmosphere in terms of temperature, humidity, and air movement. Since then his results have been amply confirmed, notably by Rubner [18], Flügge [4], Haldane [6], Leonard Hill [9].

Adequate heat regulation of the body depends largely upon the capacity for proper heat elimination, which is

accomplished in three principal ways, which vary in their relative importance according to varying external conditions.

(1) Evaporation of water from lung and skin surfaces.

(2) Direct conduction by contact with a cooler medium.

(3) Direct radiation to a cooler distant surface.

(1) *Evaporation.*—This takes place continuously from lung surfaces, and to a greater or less extent from skin surfaces. Its rate depends upon (*a*) air temperature, (*b*) humidity, (*c*) velocity of air movement.

Temperature and air movement are of primary importance in skin evaporation, and of only minor importance for the lungs. Humidity affects both kinds of evaporation, but in the skin it is the relative humidity which is of primary importance, while in the lungs it is the actual amount of moisture that determines the rate of evaporation.

(2) *Direct Conduction.*—In contact with the surrounding air, the rate of heat elimination from the skin by conduction depends upon the following properties of the air: (*a*) Temperature, (*b*) thermal capacity, (*c*) thermal conductivity, and (*d*) velocity of movement.

The thermal capacity and conductivity depend upon (*a*) the density, pressure), (*b*) the humidity, and (*c*) the temperature.

(3) *Direct Radiation.*—This is a factor of minor importance, but may need recognition in association with the other two more important conditions.

Taking, therefore, these more important conditions together—that is, evaporation and conduction—we find that the various factors reduce themselves finally to four, namely, temperature, humidity, barometric pressure, and velocity of air movement. The interrelationships of these factors are very complex, so that no simple statement of the exact physiological effect of each is possible. For example, it is a well-known experience that high temperature with low

humidity is often more comfortable than lower ones with high humidity. Here the effect of humidity upon evaporation is the predominating factor. On the other hand, low temperature with low humidity may be quite bearable, while a higher temperature associated with dampness may be distinctly chilling. Here it is the relation of the humidity to direct conduction that predominates.

In the consideration of the concrete physiological problems which I now propose, the factors of the temperature, humidity, and movement of the air will be those mainly considered, as the additional factor of barometric pressure will lead us a little too far afield.

Effect upon Comfort.

Analysis of much that has been said and written of the physical effects of air conditions, both within and out of doors, reveals the fact that the opinions expressed are very largely based upon sensation of comfort or discomfort; these are nothing more nor less than personal impressions and lack scientific definiteness.

In extreme conditions of heat, humidity, and air stagnation, there of course result certain definite symptoms, easily recognizable, and, within certain limits, common to all animal life. A sense of oppression, headache, dizziness, faintness, and nausea are symptoms with which we are all familiar. The fundamental experiments of Paul and others, already cited, were based upon the causation of such symptoms under varying atmospheric conditions of a physical nature. Such effects are not debatable. When, however, we consider less extreme conditions the situation is different. There are no definite concrete symptoms, and impressions are very variable.

Haldane [5], who has done some of the most exact work

in this field, concludes from numerous experiments that the combination of temperature and humidity records, as shown by the wet bulb thermometer, is the only reliable index, and places the maximum comfort for men at 68° F. wet bulb, while actual symptoms occur at 78° F. wet bulb.

Professor Afflick [1], in studies of gymnasium ventilation, found that 55° F. to 63° F. dry was never uncomfortable, but that when humidity was considered the individual variations were so great that definite conclusions were not possible. He found that opinions of comfort varied all the way from 29 per cent. to 77 per cent. relative humidity.

Hickox [8] also, in studies of gymnasium ventilation, found very great variation, but concluded that 58° F. to 64° F. (dry bulb) is the best for gymnasium comfort, and that variation between 22 per cent. and 65 per cent. relative humidity had no effect on comfort.

The New York State Ventilation Commission [13] found in its cabinet experiments that the subjects were somewhat more comfortable at a temperature of 68° F., but the difference experienced between this and much lower or much higher temperature was not so marked as would have been expected. The same result held good in varying degrees of humidity. One interesting finding was a decrease of appetite in stagnant air and compared with the free admission of fresh air.

In its schoolroom experiments with recirculated air there was no marked difference in the comfort votes of teachers and other observers between these two conditions, which coincides with the observations of Bass [2] in Minneapolis.

There is a noticeable lack of data in the literature as to the comfort effects of low temperature combined with varying degrees of humidity and air movement. It is generally recognized, however, that comfort in the cold depends upon personal idiosyncrasies, as much or more than at the higher

temperatures, and experience in inuring patients to cold air, which may be at first strongly contrary to their sensation of comfort, demonstrates how large a *rôle* habit plays in this matter. Many observers have noted also that feelings of comfort often depend upon contrasts. On a cold day a room at 50° F. may seem warm and comfortable, while in warmer weather the same temperature might well be uncomfortably chilly, all of which shows our power of adaptation, but does not increase our confidence in comfort sensation as an index of physical condition.

At present, however, they constitute the basis of much of our medical opinion and clinical advice in these matters.

Effect upon Physical Efficiency.

Some evidence is at hand concerning the effect of high temperature and humidity upon working efficiency. Very little exists regarding the similar effects of low temperatures or humidities. Haldane [6] found that when at work subjects were unaffected at 71° F. to 72° F. dry or 64° F. to 65° F. wet bulb, but that actual disabling symptoms occurred at 78° F. wet bulb or above. His observations coincide with others, and may be accepted as a present standard.

In the Ventilation Commission experiments it was found that body temperature and pulse-rate were raised at 86° F., but lowered at 68° F. and below, and the Crampton index of vasomotor tone was lowered by temperatures of 77° F. and 86° F., especially when associated with high humidities. Systolic blood-pressure was somewhat higher in the lower temperatures. Also 37 per cent. more work in dumb-bell lifting was accomplished at 68° F. with 55 per cent. humidity than at temperature of 77° F. and 86° F. and somewhat higher humidities. In another series 15 per cent. more physical

work was done at 68° F. and 50 per cent. than at 75° F. with the same humidity.

These results with only moderately high temperatures are interesting and of more practical value than the majority of similar experiments in which very high temperatures are employed, showing as they do that degrees of moderate heat, which are often experienced under ordinary conditions of life, are not without measurable physiological effect.

Efforts to obtain more exact physiological indices of the response to temperature than the usual ones employed of body temperature, pulse-rate, and blood-pressure were made. Studies with this end in view were made by Professor Frederic S. Lee upon the duration of digestion, the alveolar CO_2, the oxyhæmoglobin in the blood, the rate of pulse recovery, the size of the dead space in the lung, the specific gravity and the freezing point of the urine, and the excretion of creatinin, but all failed to show any definite changes as a result of various atmospheric conditions.

One of the most interesting contributions to this general subject is Ellsworth Huntington's [10] recent book, entitled "Civilization and Climate." In support of his main thesis —namely, that conditions of weather and of climate play a dominating part in the development of peoples as well as of individuals in those characteristics which go to make up the general sum of what we call civilization—this interesting writer makes use of carefully controlled observations and statistics upon the working efficiency of several large groups of workmen under various conditions.

The groups observed in these studies were operators in three factories in Connecticut, Bridgeport, New Haven, and New Britain respectively; girls in a tobacco factory in Winston-Salem, North Carolina; operators in two cotton mills in South Carolina and in two others in Georgia; a

group of cigar-makers in Jacksonville; and another in Tampa, Florida; and lastly, carpenters in Jacksonville, Florida.

From all of these diverse sources he obtains remarkably harmonious results, and reaches conclusions which may be summarized as follows:—

(1) There exists a regular seasonal variation in physical efficiency which in this climate is shown by two maximum waves, one occurring in the spring—May and early June—and the other in the autumn—October and early November—with a corresponding depression in midwinter and midsummer.

(2) The main factor in the seasonal variation is temperature. The percentage of sunshine and relative humidity are minor factors of some, but relatively slight, importance.

(3) Extremes of temperature, whether high or low, are detrimental, and there exists an optimum temperature for physical efficiency which Huntington's statistics show to be 60° F.

(4) A change of temperature, if not too great, is more stimulating to working efficiency than uniformity, and a fall of temperature has more effect than a rise. A fall of from 4° F. to 7° F. is everywhere stimulating.

(5) Efficiency is more marked at the end of a storm, and least so on very clear days. Each storm, with its changing skies, varying humidities, and slow rise and rapid fall of temperature, is a stimulant and raises efficiency.

(6) The ideal climate from the standpoint of efficiency is one in which the temperature range is between 38° F. and 65° F., where the humidity is uniformly neither very high nor very low, and where there occur frequent but moderate variations in temperature from day to day, interspersed with a considerable number of cyclonic storms.

These opinions which I have thus briefly summarized, when supported by the data and reasoning which Professor Huntington presents, deserve careful thought and critical study at the hands of the clinicians, and especially of climatologists.

Effects upon Mental Efficiency.

Of the influence of atmospheric conditions upon effective mental effort much has been claimed from time to time, but little has been proven.

Lehmann and Pedersen [12] conducted a long series of experiments upon school children, which included addition and memory tests, as well as strength tests with the dynometer. They found a seasonal variation in both the mental and the physical tests very similar to those of Huntington, with an optimum temperature for both mental and physical efficiency which varied greatly between individuals. In general the optimum for mental work was found to be much lower than that for the muscular exertion.

Huntington [11] made careful observations of the relation between mental efficiency and weather and seasonal changes, as evidenced by the study marks of cadets at West Point and Annapolis over several years. He found a seasonal variation of mental efficiency evidenced by two maximum waves each year. These waves occurred in March and in November or early December—that is, at seasons when the temperature was distinctly lower than he found to be desirable for maximum physical efficiency.

He concludes that a temperature of about 40° F. is the optimum for mental effort.

Very extensive experimental studies of mental work in various atmospheric environments have been made by the New York State Ventilation Commission. The results of

these are soon to be reported by Professor E. L. Thorndike of the Commission. In general, however, they showed very little effect that could be demonstrated by the most scientific psychological methods of investigation. The most striking result was a lack of inclination for mental work in high temperatures, such as 86° F. with high humidity (80 per cent. relative), but even here this could be overcome by the application of some increased incentive to work.

General experience with out-of-door schools leads to the impression that conditions there make for increased mental capacity. If this is true, as seems likely, it would be a rational explanation to ascribe this benefit to the much lower temperatures which obtain in these class-rooms. With the large number of out-of-door schools, there now exists so much available material for statistical investigation that it is to be hoped that some well-conducted and carefully controlled studies of this subject will be forthcoming. It would be especially interesting and instructive to know more of the actual effects of the very low temperatures often noted in these classes, for they are far below the optimum temperature for mental work suggested by Huntington, and by Lehmann and Pedersen.

Clinical Features.

There are many interesting and important applications of the physiological problem which we have thus briefly considered. At the present time I will attempt to discuss only two of the more important of these, namely, ventilation and the "fresh air treatment" of disease. The first concerns us chiefly in the conservation of health and the prevention of disease, while the latter is a generally accepted and invaluable therapeutic agent.

If we are to adapt the knowledge obtained from physio-

logical research to these practical problems, it is evident that the chief emphasis is to be placed upon atmospheric temperature.

Our standards have been largely those of individual comfort, which we have seen to be susceptible to very considerable variation, and to depend very largely upon the facility of adaptation to the body environment.

There has been a considerable amount of loose medical thinking upon this subject, and we are sorely in need of more scientific data based upon accurately observed clinical phenomena. Fully as I appreciate their shortcomings, I am not entirely in sympathy with the popular denunciations of ventilating engineers and their artificial systems.

The fault appears to me to be more one of our standards, for I am convinced that by a rational combination of open windows, a good heating plant, and a proper air exhaust system when necessary that practically any desired condition of indoor air may be obtained. The two chief faults appear to be too high temperature and too little variation in temperature.

The results of recent studies all appear to point in this direction, and were we able to agree upon new standards embodying the correction of these faults, there is little doubt of the availability of the physical means to carry them out. Any system of ventilation, however, whether natural or artificial, stands or falls by the intelligence with which it is operated, which presupposes a knowledge of the desired ends to be obtained. There would seem to be needed, therefore, a wider appreciation of the physiological importance of cooler and more variable temperatures as the prime factors in proper ventilation, to which all others, including even humidity, are secondary.

When we turn to the fresh air treatment of disease, it

would seem as though here also we have much to learn from physiological studies. If there is advantage to be derived from open air as it happens to be, it would seem as though there might be still more to be gained from skilful modification of these air conditions to meet the indications arising in various diseases or in individual cases. This would involve not only a more general knowledge of what is known of the physiological effects of various atmospheric conditions, but what is even more needed, a systematic attempt to extend this knowledge by a correlation of the physical, physiological, and clinical factors involved. This can come only through close study of the reaction of various types of disease to the atmospheric environment, and entails the use of accurate records of temperature, humidity, barometric pressure, and air movement as a part of regular clinical procedure.

It would seem, for example, that valuable use might be made of Huntington's suggestion of the effects of temperature change when the weather does not happen to supply it adequately, or that the ill-effects of certain seasons or weathers might be modified, and the good effects of others artificially reproduced by the intelligent use of means easily at our command.

The great variation in medical opinion upon these matters demonstrates the fact that our clinical knowledge is still imperfect and inexact, and that standards of procedure in various diseased conditions must be supplied by careful clinical study and experimentation.

My suggestion, therefore, is that by breaking up into its component parts the heterogeneous mass of physical and physiological factors now included in the term "fresh air treatment," and, studying the effect of each, we may be able to reach a point where the proper atmospheric conditions

may be intelligently applied to the suitable case of disease, and results obtained which would be far more satisfactory than at present, both from a clinical and scientific point of view.

I believe that we can confidently look to the members of the Climatological and Clinical Association to take the lead in this direction.

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BALNEOLOGY IN THE MIDDLE AGES.

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To-day we probably bathe our patients more often and in more varied ways than ever before. Every conceivable medium into which man may safely be put has found its therapeutic application. The subject has been subdivided by specializing adherents, so that the general term of balneology is rapidly becoming obsolete. Here, as everywhere, the stress of the times is upon us, and it is therefore with a certain hesitation that I attempt to impose upon your time and goodwill with a theme no longer of general importance, and from a remote age usually thought to be bare of practical achievement. If, nevertheless, I do so, it is because it would seem that just as we find it profitable to consult from time to time the workers in other lands, just so we should not fail to reap benefit from the labours of our forbears. Of course, if we do it only as searchers after the strange and curious, or as collectors of fine books, which in their vellum or pigskin bindings lend tone and dignity to our shelves, we bring a certain joy into our routine existence without entering, however, into the spirit and real meaning of another epoch. This we can only do when we study the sources themselves and judge them by themselves and not in relation to any other time, particularly not to our

own. Then only we can acquire the historical sense which does not measure everything by the standard of material and technical advancement. Approached in this spirit, it will be found that the Middle Ages, of all historical epochs the most niggardly treated, is apt to radiate an inspiring amount of light from its reputed darkness. What has been lacking, and to a great extent still lacks, is a sufficient amount of documentary evidence. Increasingly this is being brought to light from archives and libraries furnishing the building material for such brilliant syntheses as Dr. J. J. Walsh's "The Thirteenth Greatest of all Centuries," or Henry Osborn Taylor's "Medieval Mind."

From our civilization of strenuous progressiveness and innumerable bath-tubs we gaze sympathetically to that of ancient Rome, with its luxurious thermæ and other provisions for bathing in health and illness. There is something romantic in such contemplation and gratifying to our pride, inasmuch as we imagine the intervening historical periods as steeped in filth and unbathed bliss. We are told that only in the seventeenth and eighteenth centuries the apostles of water and cleanliness arose, Locke, Floyer and J. J. Rousseau, and to them alone we give credit for our own superlative cleanliness. The facts opposing this traditional view are so numerous that I can endeavour only to cite some of them in chronological sequence, in order to give a bird's-eye view on bathing Europe up to the advent of that cultural epoch known as the Renaissance.

Balneology, usually regarded as one of the empirical branches of therapy, has never enjoyed great favour from that school of medicine whose prime endeavour is, and almost always has been, to raise itself to a position among the exact sciences. The mediæval physician aimed at therapy primarily, and while inclined to rely on authority, he was

not afraid to use common sense and to pay attention to popular remedies, among which the bath was probably one of the earliest. The ancient Greek and Roman writers who belonged to the school of medicine—Hippocrates and Galen, for instance—mention balneological measures only sparingly, while the lay writers—Livy, Horace, and Celsus—go to great length and detail. We have to turn to men of no particular scientific standing like Antonius Musa, who, because he cured the divine Augustus with cold bathing, is usually cited as the founder of hydrotherapy; to Charmis, who in Nero's time revived sea bathing. Only in the tenth century a book was written by a great physician, Paul of Ægina, in which for the first time balneology was comprehensively outlined, including a systematic discussion of the different mineral waters and their therapeutic value for various ailments. Paul's work is like a posthumous message from an older to a newer civilization, the latter differently constituted by admixtures of new blood. It exerted, of course, no influence on the balneology of the early Middle Ages, which was well under way then.[1]

It has been asserted that mediæval balneology developed entirely independently of its classical prototype. This seems an exaggeration, for it is well known that most of the invading kings of Italy made efforts to copy the Roman model and restore the ancient order of things. Theodoric, the Ostrogoth, certainly did. Though by no means lacking in powerful individuality, his court and government were shaped on the better Roman models. It is to his

[1] Paul of Ægina may also be called the first medical historian of balneology, because in his works is found a comprehensive statement of the baths therapeutically employed in antiquity (*see* the edition of his works by Francis Adams, vol. i, pp. 67-73).

Byzantine physician, Anthimus, that we owe the first and only medical treatise of the time which enjoyed a long popularity. We also have a letter from Theodoric to his architect, Aloysius, which, if authentic, would constitute the earliest document on our subject in the Middle Ages. In it Theodoric dwells on the advantages of baths and mineral springs, mentioning those of Abano, near Padua, and orders Aloysius to repair the ancient installations.[2] But indirectly the greatest influence was exerted by Cassiodorus, whom Theodoric had taken over from Odoacer and invested with the highest positions of state. From him we have that interesting decree outlining the duties of the official physicians, but his help to balneology we can see particularly in his efforts to induce the monastic institutions to a cultivation of intellectual and medical pursuits.

But I must leave off here for a moment in order to analyse from another point of view the origin of bathing habits among those northern tribes whose national peculiarities gave the determining colour to the whole epoch. It may be assumed as a general proposition that primitive people had a more fervent belief in the powers of healing springs, and that they made early use of them. Archæological research not only in Europe and Asia, but also in America (Aztec and Indian), have revealed the ancient provisions for bathing in water and in steam. We also know that the North American Indians would fight in the defence

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2 "Sive in thermis, sive in cuniculis fuerit aliquid reparandum." Quite a considerable literature about Abano appeared already in the Middle Ages (*see* Köstl, "Die Euganeen oder die Thermen von Abano," 1843). Ennodius, Bishop of Pavia (died 521), went to Abano for treatment of an eye trouble. He wrote one of the earliest and best poems in praise of these baths.

of their healing springs. The earliest reports we have about the Teutonic tribes mention uniformly their love of bathing. Thus Cæsar tells us of their bathing and swimming in rivers, and Tacitus specifically speaks of their hot baths.[3] Useful evidence of the autochthonous origin and development of their bathing habits may be found in a study of the words used by them to designate the various applications of water to the body and the changes which the sense of these words underwent in the course of time. In the English-Latin dictionary of the fifteenth century, the "Promptuarium Parvulorum," we find the two words "*bathyn*" or "*stuwyn*" for the Latin "*balneo*." These are without doubt old Germanic words, related in no way to any Romance tongue. On the contrary, it can be shown that the latter took them up. Both of these words, and not only the second, seem to have expressed originally the idea of warm or hot bathing. The old High-German word "*bayan,*" being the root of the old Saxon "*bath,*" Anglo-Saxon "*boeth*" and English "*bathyn,*" meant, as it still does in German "*bähen*"—"to foment." The second of the two words in the Promptuarium, "*stuwyn,*" still preserved in our "to stew" and the noun "stove," has apparently lost its relation to our present-day conception of bathing, but in the period under consideration it had this significance. Originally derived from the old German "*stiuban,*" "*stieben,*" "*stoup,*" very likely related to the Anglo-Saxon "*steman,*" "*styman,*" and gradually transformed into the German "*stieben,*" "*Staub,*" and the English "steam," it came very early to designate a special locality, a hut in which steam was raised by pouring water on hot stones or heating it in

[3] "De Bello Gallico," vi, 21.

a kettle or tub.[4] Such lightly built huts we know to have existed, as they exist even in the present day in some countries; they formed the original German "*Badestube.*" *A priori* we think of the vapour bath as an institution peculiar to the Slavic races and of the tub as the Germanic bathing implement. There cannot be any doubt about the antiquity of the Slavic and Finnish steam bath, but it is difficult to ascertain whether it preceded or followed the Germanic "*Badestube.*" It speaks for the latter alternative that most Slav peoples, just as those inhabiting ancient Gaul, Spain, and even Italy, took up the Germanic term "*Stube*" for the designation of certain bathing arrangements. So we find it in the old Slavic words "*istuba,*" "*izba*" (Lithuanian "*stuba,*" Lettish "*istaba,*" Finnish "*tupa,*" Hungarian "*scoba,*" old Prussian "*stubo*"), in the old French "*estuve,*" old Spanish "*estufa,*" and old Italian "*stufa*" and "*stufare.*" It is curious that only in the modern Italian has this word preserved the significance of washing and bathing, while in the English, French, and German languages this sense has been lost altogether.[5]

But I must return now to monastic balneology. The full extent of the monastic movement and its significance to

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[4] In a manuscript of the British Museum (Harl. 2,378) the following description is found: "For to maken a dry Steuwe. Take a fatte (vat) and cover it o-bouen with clothis and take iii or iiii grete stones in the fyre; and whanne yei ben hote I-nowe, ley oper colde stones in ye fattes botume, and the hote abouen and sette a stole besyden and go into ye fatte, and setto ye on y stole; and take a lavour fulle of colde water in thyn hande, and ay as you will have it hattere poure a litill of ye watere yere-on; and yus is made, or elles ley vm (around—the German *um*) ye hote stones herbes yat are beste for bathes." (Transcription in G. Henslow's "Medical Works of the Fourteenth Century," London, 1899, p. 100.)

[5] In Richard Hakluyt's "Voyages" and Purchas's "Pilgrimage" (16th century) the words "stoue" and "bath stoues" are still used in the old sense.

the organization of a new order of things is not always realized. Most of the monasteries were built between the years 520 and 700. From the sixth century to the beginning of the fifteenth 15,070 monasteries were counted in Christian Europe, which had a total population of only 15,000,000 in the thirteenth century, according to Walsh's estimate. These figures alone give an idea of the tremendous potentiality of these institutions. As to the quality of this influence opinions have differed, as a great deal of adverse criticism was brought forward against them and led to their dissolution in some countries. The debate on this subject is still on and does not concern us here, but to the unbiased student of mediæval history it is very apparent that the beneficial effects of monastic activities in so many fields of human endeavour through centuries far outweighed any pernicious ones due to those shortcomings and abuses which are unavoidable in any large organization. We have only scantily written records of the early medical activities of the monks. Their scriptoria during the 900 years prior to the advent of the printing press have supplied the greater part of the literature, which dealt mainly with theologic and philosophic subjects, while the monks attended, unrecorded, to their samaritan duties. To reconstruct this part of their activities we have to look for another kind of record. We can find it if we study the structural arrangements of the monastic buildings in some of the ancient plans which, fortunately, have been preserved, while hardly anything has remained of the oldest buildings themselves. The oldest extant plan of such a convent, founded in the year 820, is that of Saint Gall in Switzerland. By a comparison with still remaining foundations of older as well as more recent convents, this plan has been shown to represent the building type adhered to in most of the monasteries

of the Middle Ages. By a careful selection of the site, due regard to the sizes and convenient distribution and location of the rooms according to their purposes, and by a scrupulous attention to an abundant and healthy water supply, its canalization, proper sewage disposal, &c., the builders of these monasteries showed an extraordinary insight into hygienic requirements. Alfred Martin, in his beautiful book on the history of German balneology,[6] has given a detailed description of the bathing facilities provided. In some instances he had to compare the inscriptions on the original plan with other documentary evidence to make them clear. He has succeeded admirably, and I cannot do better than follow his description.

The convent of Saint Gall comprised several larger and smaller buildings grouped around the church. The more important ones were connected with each other by covered passage ways. Bathing facilities were provided in special and separate structures for the four principal buildings, viz., the dormitory of the monks, the house of the novices and students, the infirmary, and the servants' house, with which some were connected by means of closed-in passage ways, or directly accessible through a door. The largest, the bath house for the monks, was divided by a wall into two compartments. In the plan benches are indicated against the four walls of both rooms; one room has in its centre a square object, while two round ones are indicated near the middle of the other. The whole place is called on the plan "balneatorium et lavandi locus." The view has been expressed (Kochendörfer) that this bath house was connected by means of hollow flues with the heating plant below the dormitory

[6] Martin, Alfred: "Deutsches Badewesen in vergangenen Tagen," Jena, Diederichs, 1906. With 159 illustrations from old originals.

("subtus calefactoria domus supra dormitorium"), and so might have served as a sudatorium. But this seems unlikely, because of the distance from the calefactorium. It seems more plausible that the square object in the first room was a hearth or stove on which water was heated in kettles to be used for bathing in the round tubs in the adjoining room. An amusing story, told by an ancient chronicler of the monastery, Ekkehard, supports this explanation. A stranger, speaking only the Romance tongue, was one day brought in a wheelbarrow to the convent praying for admittance. He claimed that both his legs were paralysed. He was received kindly and a bath prepared for him. After his portly person had been put -not without trouble—into the tub he complained that the water was too hot; in his mother tongue he shouted "Cald, cald est," whereupon the accommodating monk fetched "the sizzling kettle" and poured some more hot water into the tub. More vigorous yells of "Cald est" and more hot water until the stranger, forgetting his lameness, jumps out of the scalding water—an early example of successful psychotherapy!

But to return to the convent plans. We have a direct record that a patron of the monastery had provided for use in its bathrooms ivory combs to be attached by metal chains, as well as towels for each monk. Another building annexe contained the privy (necessarium) with separate seats (sedilia). The infirmary formed an interesting building complex apart: it comprised the hospital proper with separate and easily accessible bathroom, single rooms (probably for isolation), the refectory, and chapel. Entirely separate but close by stood the physician's house with its garden of simples, and another structure "for blood-letting," probably a sort of surgery. In the other houses certain rooms were also used for bathing, blood-letting, and

cupping—as, for instance, in the house for travellers and poor guests (domus peregrinorum et pauperum).

We see that in this plan very excellent provisions had been made, and it needs no very vivid imagination to picture the mode of their current utilization. Their repetition in other monasteries through long periods of time suggests that they proved satisfactory and answered deeply rooted requirements. Similar planning we find in a sketch on a psalter for the twelfth-century Abbey of Canterbury, and this is confirmed also in several Cistercian convents at Clairvaux, Citeaux, and other places.[7] That in some of the religious orders of the time no such attention was given to bodily care cannot be denied. Also, it must be remembered that abstention from bathing was considered by some ascetic individuals as a high virtue, in line with other self-inflicted discomforts and pains. Thus Thomas à Becket's saintliness became immediately clear to those who cared for his body immediately after his murder—it was covered with filth and vermin! Similarly, the story of the pious monk who warded off the amorous advances of a worldly lady by letting her glance underneath his cassock! Such occurrences were exceptions, and must be recognized as such; they only enhance the prevalence of opposite habits.

The continued provision of these monastic bathing arrangements in the setting we have tried to describe by itself suggests that ample use was made of the baths for medical purposes. It was probably here where the artificial baths, the salt baths, the herb baths, which came to enjoy such general popularity, were elaborated. Also by settling near famous old mineral springs did the monks promote

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[7] As late as 1403 the Cistercian "Hirschberg Warmbrunn" flourished as a watering place.

that particular feature of balneology which still enjoys a considerable vogue.[8] That they made use of cold bathing therapeutically may be suggested by a passage in a letter of Arnulf, Bishop of Lisieux, to Pope Alexander III (1159-1181), asking for the dissolution of the Benedictine Abbey of Grestain, because of the misconduct of the monks, charging that they had killed a sick woman by immersing her in a cold bath under pretext of a miraculous cure.

Parallel with, influenced, and fostered by monastic balneology, the various hygienic and therapeutic measures within its range developed among the peoples of Germany, France, and England very similarly. Kings and princes of State and Church helped the development in many ways.[9] Already Charlemagne, like Theodoric, showed his interest. It was the attraction of the hot springs at Aachen that induced him to erect a palace there.[10] His legendary con-

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[8] A great many interesting details can be found in B. M. Lersch's "Geschichte der Balneologie, &c.," Würzburg, Stahel, 1863. Thus the hot springs of Luxeuil were the property of the monastery founded by St. Columban in 615. The Benedictines from earliest times showed a special interest in mineral springs. Those of Arles, in French Provence, belonged to them in 786; about the same time also those of Burtscheid, which later was transferred to an order of nuns. The famous saline spring of Kissingen already in 823 belonged to the Benedictine Abbey of Fulda. The springs of Pfeffers, which Paracelsus preferred to all others, belonged to a monastery as early as the eleventh century. The Roman thermae of Bath were restored by Bishop Joannes, of Tours, in 1090, and connected with his palace. His successor, FitzJocelyn, utilized them in his Abbey, and up to 1544 it remained monastic property.

[9] We have reports of several early papal efforts in this direction. Hilarius (464) built for the monastery of St. Lawrence special bathrooms; Hadrian I (759) and, similarly, Gregory IV (844) recommended to the clerics the regular processional to the baths.

[10] An interesting poem by the Benedictine Guinterius Ligurinus dealing with the baths at Aachen in 1152, at the coronation of Frederic Barbarossa, is given by Lersch (*op. cit.*).

nection with the still famous waters of Karlsbad is well known. Already in Merovingian times the Lex Allemanorum and Bajuvorum made specific provisions for the bath houses. A special profession, that of the "balneator," the "Bader," sprang up, which later—at least in Germany—formed a special guild besides the barbers and surgeons, complicating still more the already complex feuds between these two. Knighthood, though "in flower," is usually thought to have dispensed with bathing. The Minnesingers, troubadours, and minstrels, however, are not responsible for this tradition of hydrophobic propensity among their heroes. Many of their songs mention bathing. The Order of the Bath, although created only in the eighteenth century, has surely its origin in the Middle Ages. The obligatory bath for the Knight-Bachelor on the day before his admittance to full knighthood had surely more than a symbolical meaning. The yearly pilgrimages to the healing springs in the month of May, the baths of the women on St. John's Day, which Petrarca describes so picturesquely in one of his letters from Cologne, were ancient survivals, indications of a deeply rooted love for and belief in the purifying powers of the liquid element. These seasonal wanderings to the healing springs were naturally brought into relation with astral conjunctions, a tendency soon exploited by the calendar makers and astrological physicians. Days and hours were set for bathing, blood-letting, cupping, and purging, carefully ascertained by the position of the stars. Martin in his book gives a great variety of such instances which offer interest from many points of view.

The desire for a more accurate understanding of the agent employed with the intent of greater precision in its therapeutic application is a purely human tendency, and

not confined to the enlightened stage of civilization which we believe we have reached. If we take the trouble of searching we encounter it everywhere, also in the Middle Ages. With the establishment of medical schools this tendency becomes focused, and multiplying records of efforts allow us to analyse the results. The first contributions in this direction we should expect from Italy, the cradle of European culture, and particularly from the south, the old "regno," where at Salerno the first medical school arose. From the medley of component elements—Lombard, Norman, Teuton, Italian, Greek, and Saracen—it is not always easy to trace the prevailing factors to their origin. We know of the great Hohenstaufen Frederic II's admirable regulation of medical study and medical affairs generally, in Salerno as well as Naples. But that happened only in the thirteenth century, and the Hippocratic community had then already existed for at least 300 years. Whether of autochthonous or other lay origin, or created through monastic influences, notably of those exerted by the settlement of Benedict of Nursia on Monte Cassino, are still open questions, but there can be no question about the importance of the Salernitan school in the tenth century. Placed charmingly near that lovely bay of azure sea, under cloudless skies, and well sheltered from the cold tramontano amidst luxuriant vegetation, Salerno attracted already in the early days of the Norman adventurers the weary and sick, thus forming the prototype of the climatic resort. The tendencies of the medical school were in the direction of Hippocratic dietetics, and only in later days influenced by Arab teaching. And just as we have missed in Hippocrates a marked interest in balneology, it also is lacking in Salerno. The famous "Regimen sanitatis," the popular code of health

for the entire mediæval period, barely mentions bathing. This is rather surprising, but there seems to be an explanation for this puzzle.[11]

Salernitan affairs were not entirely devoted to the pursuit of high humanitarian ideals; there entered commercial considerations equally. Salerno could offer the best medical and surgical skill of the day, together with the advantages of a superior climatic resort. In these two factors it had to fear no competition. But to the north, across the hills and bay, was her natural rival, Naples, close to a district famed from ancient times for the immense variety and number of its mineral springs. Puteoli, Sulfatara, Cumæ, Bajæ were some of the names of far-famed springs which must have had an irresistible attraction to many seekers after health. In this we must see the explanation for Salerno's surprising attitude towards bathing, and this view is strengthened by some evidence showing that Salernitan adherents even used aggressive methods to damage her rival.[12] How successful Naples was in the competition with her powerful neighbour is difficult to say. But we have evidence that a

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[11] The rôle played by the Benedictine order of Monte Cassino in the foundation of the medical school of Salerno is not yet definitely ascertained. Its creator, Benedict of Nursia (543), is known to have recommended baths to his friars. Some time later elaborate bathing facilities were provided at Monte Cassino. That in this direction some influence was exerted on Salerno is suggested by an Act of 1110, which mentions "balneum monasterii quod de S. Sophia dicitur," also a lease to a Benedictine (1164) of a separate bath house with heating facilities, probably open to the public (from documents brought to light by Garufi: "Studi medievale," Milan, 1904-5, vol. i, p. 276). The Jewish traveller, Benjamin of Tudela, who visited Salerno late in the twelfth century, reports about petroleum springs and their therapeutic utilization. There may have been a greater balneological activity in Salerno than appears from the medical writings.

[12] It is reported that they destroyed the marble tablets on which directions were given for the use of the baths.

balneological activity extended through a long period of time. It certainly has furnished us with the first balneological literature. Like the "Regimen sanitatis Salernitanum," it is a poem which enumerates the different springs by names which are not always clear, describing their characteristics and their efficacy in the different diseases for which they are recommended. We possess several versions of it in manuscript. One version, of which the manuscript seems to be lost, was published in print in 1475 by Giovanni Elisio, a Neapolitan physician. It is easily accessible now in the collection "De Balneis" of 1553, where it is attributed to Alcadinus poeta Siculus. Its metre, language, and descriptive power speak well for its author, whom we find it difficult to identify. Giacosa[13] has brought to light from the codices of the Angelican Library in Rome, together with most interesting contemporary paintings, an account of the baths of Pozzuoli and their uses, which corresponds fairly closely with the subject-matter of the poem of Alcadino. The author in one manuscript is called "the physician Giovanni,

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[13] "Magistri Salernitani nondum editi," Torino, Bocca, 1901 (pp. 333 and 341), the reproductions of the miniatures in the separate Atlante, Folio, tavole 28 to 33. There are eighteen miniatures in the Codex Rome (Biblioth. Angelic.) 1474 of the thirteenth century. They are finely painted in tempera of beautiful colouring, the background in gold (black in photographic reproduction). They represent in the primitive art of the time the different baths in use. In the text (p. 341) the author is given as Alcadinus, but in one of the last verses one reads: "Ebolei vatis Cesar reminiscere vestri." Giacosa thinks that this points to Pietro da Eboli's authorship, although in other versions (De Balneis," 208) instead of "Ebolei" stands "Euboici," which conveys a much clearer sense, referring to the ancient tradition of the Eubœan land (Cumæ), instead of to Eboli, situated some ten miles from Salerno. De Renzi ("Stor. docum. Salern.," p. 409, and "Coll. Salern.," vol. i, p. 288, was the first to attribute the poem to Pietro da Eboli by a very plausible argument which has been accepted by many (*see also* Choulant, "Bücherkunde," second edition, p. 313).

son of the physician Gregory." Giacosa believes that he has traced both versions to one common source, to a Pietro da Eboli, a physician who had occupied distinguished positions in the reign of Frederic II and Manfred. But he has evidently overlooked the fact that the Alcadino version is clearly dedicated to "Henricum Imperatorem," which can mean only Henry VI, in whose reign Sicily became part of the Empire in 1194. This would place the author of the poem into a time prior to that of Frederic II and of Pietro da Eboli. But the origin of the poem is probably still earlier; the fact alone that we have so many attributions speaks for it. Ugolino da Montecatini, of whom we have still to hear, found another version attributed to Matteo da Plantimone, also in another manuscript. He published it in his balneological treatise, which also is reprinted in "De Balneis." Treating of the same subject and districts, all these versions have naturally many points of similarity; but even if they can be shown to be derived from a common source, they vary enough to allow the supposition that the variations represent actual changes in the balneological practice in the course of time.

The diseases that stand out in this poem as the ones most likely to be benefited by the use of the various baths are: the group of skin diseases, very prevalent at the time, scabies, and leprosy; then come the rheumatic troubles and gout, then the "struma," by which term various ailments, not only goitre, were designated, especially glandular swellings of the neck, and for which also the term "scrofa" was employed. Furthermore, we find the various female disorders, the different fevers, malaria and its sequelæ, the febres hecticæ, consumption of the young and old, rheumatism, and gout. The distinction of the different springs at that time was probably made only by eye, feeling, and

taste. Only Paracelsus, much later, provides the chemical test for iron waters. But these older balneologists with the crude means of distinction managed to differentiate clearly between nitrous, saline, aluminous or styptic, sulphurous, and bituminous waters. Two of the versions mention a Balneum petrolio, situated near Cumæ, that place across the hill from Pozzuoli on the open Mediterranean where Euboean barks discharged long ago their crews and goods to implant Greek culture on Italian soil. Petroleum and asphaltum sources were known to Pliny under the general term of bituminous, but their employment *in status nascendi,* I believe, is a novelty peculiar to our poem. The Angelican version and that of Plantimone, not the one of Alcadino, mention iron springs.[14] The omission in the latter may also speak for its earlier date, inasmuch as the spring mentioned is not in the Pozzuoli district. All the versions mention the Balneum tripergulæ, called so, perhaps, because of the triple arrangement of its rooms after the Roman system—viz., dressing-room, calidarium, and frigidarium. It is situated near Averna, that sinister sheet of water which no bird can cross alive. Marking from oldest times up to Dante, who visited it—the entrance to the inferno, legend-enshrouded—it was also the favourite dwelling-place of the Sibyl of Cumæ, to whom Christ appeared here one day, as is recorded in our poem. I have visited what remains of these baths on the back of a sturdy Neapolitan, for its floor is under 2 ft. of water. Hewn into lava rock, with its passages, rooms, and reclining seats, it is interesting enough, but as to its antiquity and former purposes I should

[14] The bath is named "Balneum resina ferruginosum," which may point to the still-existing Resino at the foot of Mount Vesuvius (Giacosa).

not like to express myself without much closer archæologic scrutiny. Several of the thirty and more baths enumerated in the different versions of the poem cannot be identified thus far; perhaps someone will do it and increase our knowledge of this most interesting colony of baths.

Francesco da Piedimonti, born at San Germano in the district that has just occupied us (he died in 1320), was a famous pupil of Salerno in the time of its decline. Favourite and physician to the second Angevin King of Naples, Robert,[15] he became Professor of Medicine at the Neopolitan "studio."[16] He is the first among Salernitans to do justice to the baths of Pozzuoli and to balneology in general. Although particularly adept in obstetrical practice, he has written a general medical treatise. The balneological part of this, reprinted in "De Balneis," is worth while reading. The space is lacking for a detailed analysis here. I will note only his reference to blood baths, said to be used by the Sicilians in the treatment of leprosy, thereby touching upon an ancient tradition, probably of biblical and talmudic origin.[17] Interesting also is his balneologic treatment of senile hectics, his description of a great number of mineral waters, and his directions for the preparation of artificial ones.

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[15] Not of the Norman Robert and not of the King of Sicily, as sometimes stated. Robert Guiscard was dead almost 100 years, and Charles of Anjou had to relinquish Sicily after the "Vespers" (1282), so that none of his successors up to the year 1442 could claim that title.

[16] In 1225 Frederic II had founded the University, but in 1231 he transferred the teaching of medicine from Naples to Salerno with exclusive privileges. Only under Angevin rule, in 1266, the Neapolitan school was again established.

[17] For further details see J. Preuss, "Biblisch-talmudische Medizin," Berlin, Karger, 1911.

The work of a man like Francesco makes us regret that we have so little information about the school of Naples, which, visited by great scholars, Thomas Aquinas and Arnoldus de Villanova amongst them, must have exerted a considerable influence upon contemporaneous thought and achievement.[18] Salerno and the intellectual development in the north have distracted attention from it. There we find the oldest of the *studia generalia—i.e.*, the universities—Bologna, in fullest bloom, assembling already in the year 1200 as many as 10,000 students, so that a new one, fed by the overflow, becomes necessary, and is established in Padua (1222). The intellectual horizon was widening, the Crusades had brought Orient closer to Occident, Arabian learning was becoming firmly implanted upon European soil. It brought ancient learning, and especially medicine, to a more general appreciation, but also the scholastic method, with the tediousness of its syllogistic and subtilissimistic argumentation. Whether balneology developed by all this it is hard to decide. At any rate, the balneology of the earlier Middle Ages was slowly evolving from a simple handmaiden of plebeian antecedents into the favourite courtesan of the ruling classes, intellectual, secular, and ecclesiastic. Signs of degeneracy gradually became apparent, the increasing licentiousness found a suitable field for free indulgence in the opportunities offered in the public bathing places which had sprung up everywhere in towns as well as in spas, and where males and females mingled freely

[18] Arnoldus, in his "Breviarium practicæ" (Pavia, n.d.; Ven., 1494, 1497), refers to his sojourn and study in Naples. He mentions his medical teacher, Casamida, and also recommends the baths of Pozzuoli, especially for renal and vesical calculus. The life-history of this most eminent physician is not yet definitely ascertained, and especially his Neapolitan sojourn and his authorship of the "Breviarium" are still *sub judice*.

in and out of water in Paradisian garb. This, however, indicates only one tendency more pronounced in some places than others, and does not allow generalization. But it presages coming trouble fostered by protracted wars, pestilence, and difficult financial conditions. The greatest blow to balneology, apart from the increase of the cost of fuel, came at the end of the fifteenth century with the alarming spread of syphilis, which was thought to have been fostered through infection in the bathing places.

During the 200 years which preceded the end, and for some time afterward a great number of balneological writings were produced; some are still extant in manuscript form only, but most of them have been printed. The baths situated near the great centres of learning, Bologna, Padua, Perugia, Florence (Pisa and Lucca), Pavia, Siena, and in France Montpellier, which was gradually taking the position Salerno occupied, received, naturally, the painstaking attention of the medical men engaged in teaching and practice there. Thus we are particularly well informed about such springs as those of Porreta, Abano, Lucca, Corsenna, Avignon; but also from across the Alps, and, in fact, from everywhere in civilized Europe can we now find writings about old and new watering-places. The intellectual giants representing the best medical thought in the thirteenth century were Taddeo Alderotti (1223-1303) in Bologna and Pietro de Abano (1250-1315) in Padua. Taddeo, a man of monumental learning and colossal fees, is largely responsible for the introduction of the scholastic method into medicine. It was the lawyer's method, highly cultivated in the Bolognese school, which primarily was a law school. The prolonged and subtle analysis of traditional information is difficult for us to understand, brought up as we are to consult only direct evidence, even if we do go to very great length

and finest distinctions within this field. To record the various stages and final results of scholastic argumentation must have taken an immense amount of time, and it is astonishing that occasion was found at all for personal observation and experimentation. Not much of the latter we find in Taddeo himself, but in some of his pupils. Pietro de Abano exerted an equally strong influence mainly arabistic. Although hailing from the place of ancient thermæ, which we have already encountered, he does not seem to have had a special leaning towards balneology, but of course he does argue about it. Pietro de Torrigiani, a prominent pupil of Taddeo's, wrote the "Canones balneandi," rules for bathers which enjoyed great vogue throughout all Europe. Another one of Taddeo's pupils, an enthusiastic admirer of Pietro de Abano, was Gentile da Foligno (died 1348), also a great money-maker and promoter of the logical against the empirical method in medicine. He wrote a little treatise on the waters of Porreta, the chief interest of which may be found in the fact that it was the first to appear in print (1473). In Giovanni de Dondis we usually hail the early apostle of exact balneology. Whatever his right to such honour may be, it must be mentioned that it rests on his attempt to extract the salts of the thermæ of Abano. He was a serious man of a very great reputation, an opponent to polypharmacy, and much thought of by that great hater of physicians, Petrarca. Of similar type, though much later, is Michele Savonarola, representing Padua and the new school of Ferrara. To him European balneology owes the most ambitious work on the mineral springs of all the countries. But the man who in his personality has been brought closer to us than any other physician in mediæval times through happy finds in old archives is Ugolino Caccino, of Montecatini (died 1425).

He came from that thermal district not far from Florence, in the Valdinievole, which has still preserved its ancient reputation as a spa. Evidently he was a man of broad and open-minded scholarship, who in his treatise on all the Italian spas, the first thorough one of the kind, gives the results of his own personal observations, stating clearly when he is reporting from the information of others. This treatise formed the basis of later writings, the authors of which did not find it necessary to cite Ugolino, "imitando la vecchia cornacchia della favola, che si faceva bella delle piume non sue."

Many others who wrote on the subject I could name, up to the time when Thomas Giunta, "for the good of humanity," but also to put into proper relief the balneological resources of his country, assembled all their writings in his imposing collection, "De Balneis."[19] Matteo Bendinelli (1489) sums up for them all, in his treatise on the baths of Lucca and Corsenna, the general tendency of that time, which I believe approaches very closely our own: "And as it is impossible for the physician to cure any ailment without knowing the disease, so it is impossible for the physician to acquire honour from the employment of baths without knowing their minerals." But there is also a human side touched upon in some of the treatises in "De Balneis" which it would be difficult to find in any modern treatise. I cannot refrain from calling attention to one, to that delightful *confabulatio* which gives an account of a three-days' visit of inspection to the baths of Caldariani by what we might call a balneological commission of prominent

[19] "De Balneis omnia quae extant," Venice, Giunta, 1553, fol., 497 leaves. This fine collection, the first text-book on balneology, offers to the interested student a mine of information.

citizens of Verona. Pantheus, the humanistic spokesman; his responsors, the erudite magistrate, Hermolaus Barbarus; Meardus, the local physician; and several other worthy gentlemen address each other in classic Latin. The dialogues have to be read to be appreciated; they give a beautiful insight into the manners and ways of the times. The conversation dwells on all the famous Veronese, on Pliny, on Macer, on Catullus, on Vitruvius, on all those who in ancient times had written or sung of the virtues of the waters and the glorious beauty of the land. Virgil and Ovid and the other bucolics are freely cited, and we hear of delightful promenades in the early morning hours, of delicious feasts at other times—in general, a charming picture of rural bliss in the setting of the classical spirit of the Cinquecento without any tedious insistence on the technical consideration of the spring itself. Although we do not find this sort of balneological report in our scientific annals, let us hope that the sense for it is not entirely lost. There are other things but pure facts worth considering.

HYDROLOGY IN MILITARY PRACTICE.[1]

By GUY HINSDALE, A.M., M.D.
HOT SPRINGS, VIRGINIA.

"The old order changeth," and nowhere will the change be more noteworthy than in the attitude of travellers and health-seekers toward European spas. American and English tourists will some day seek again the Continental watering-places, but it is safe to predict that a generation will pass before they flock to Teutonic resorts as in the past. We shall never hear of a British King visiting Homburg again, and it is doubtful if Americans will spend their millions annually in Karlsbad, Wiesbaden, and Nauheim for years to come. British watering-places will undoubtedly have a revival, and the innumerable French spas will surely gain immensely in popularity with all English-speaking travellers. This is but natural, and it does not require a prophet to foretell it.

In England a systematic effort has been made in the last year to afford wounded and invalid soldiers and sailors the benefits of spa treatment at home.

A committee of the Royal Society of Medicine has been charged by the War Office with this service, and has carefully examined its resources with this end in view. The peculiar adaptation of each one of the forty-five different

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[1] Lantern slides illustrating the equipment at Harrogate, Buxton, Bath, and Droitwich were forwarded from those spas at the request of Dr. R. Fortescue Fox, an Honorary Member of the Association, for which we acknowledge our indebtedness. These were used to illustrate the Author's remarks.

resorts has been stated in a report recently issued, and consequently their doors have been opened to thousands of soldiers and sailors invalided home. No doubt the soldier who is sent to Buxton, Harrogate, or Bath will be more fortunate than his comrade who finds himself in the best of London hospitals unless he needs the special skill of some metropolitan consultant. Even the remedial uses of air and water may often overbalance the skill of the best specialist.

It is the intention to distribute cases wherever the best treatment can be afforded, and it is found that the spas and other bathing establishments in Great Britain afford special advantages for after-treatment.

The surgical affections which are amenable to treatment in this manner include contusions and bruises, sprains and strains of joints, fracture near joints with immobility, fractures imperfectly healed, unresolved effusions, fractures with osteitis and necrosis (obstinate cases), wounds unhealed and painful scars, cases where arterial circulation is locally deficient, as from the effects of pressure or frost-bite, and, finally, cases after operation.

Ills Spas may Heal.

Among the medical affections appropriate for spa treatment are rheumatic disorders, fatigue, fever and muscular rheumatism, or subacute fibrositis, all of which are liable to follow fatigue and exposure; sciatica and lumbago, convalescence from rheumatic fever, chronic articular rheumatism, synovitis, and degenerative arthritis.

Among the circulatory disorders are defective peripheral circulation, cardiac dilatation, Graves's disease, and tachycardia.

Nervous diseases form a very important class, including the condition of nervous shock resulting from traumatism,

mental shock or operation, neurasthenia and psychasthenia, irritative conditions with excitement and insomnia, and melancholia. Then, also, the palsies, both central and peripheral, the atrophies and the terrible cases of peripheral neuritis and kindred afflictions which Drs. Mitchell, Morehouse, and Keen cared for during our own great war. Then comes the long list of digestive, hepatic, respiratory and cutaneous disorders. The committee has indicated appropriate climatic and hydrologic treatment, and the particular places where these can be afforded.

I have recently received from Dr. Charles W. Buckley, of Buxton, an account of the treatment afforded soldiers at that famous spa. In his letter he says:—

It will perhaps be best if I first describe what is being done here. Buxton, with Bath and Harrogate, are doing very much the same in the matter, while the smaller spas, Droitwich, Woodhall Spa, Llandrindod, Strathpeffer, &c., are using their resources so far as they go.

In Buxton the large mineral water hospital, known as the Devonshire Hospital, which has 316 beds and a complete installation of baths, has placed 200 beds at the disposal of the military and naval authorities for the treatment of rheumatic disorders and such other conditions as are likely to benefit by the Buxton climate and special forms of treatment. About 1,500 patients have been treated so far with a very large proportion of cures. Very few cases of wounds are received, and only those in which massage or similar treatment is required for the treatment of stiffness, nerve injuries, &c. A fair proportion of cases of nerve shock are sent, but, except in the milder forms, would be better treated in institutions more especially devoted to that class of case. The great bulk of the cases are rheumatism, articular or fibrous (muscular), sciatica, gonorrhœal and traumatic arthritis, and what is known as "Flanders foot," a form of frost-bite due to standing in trenches up to the knees or higher in cold water.

There is also a Red Cross hospital of fifty beds; the cases are of similar type, but with a larger proportion of men sent to convalesce after wounds. They have their balneological treatment at the municipal bathing establishment. In both hospitals, while mineral water treatment, baths, douches, &c., is the chief therapeutic measure, massage and electrotherapy, especially ionization, are employed.

The Canadian Red Cross Society have just established a hospital of 300 beds in the town for the treatment of special cases, similar to

those dealt with at the hospitals already referred to, but it is expected that cases of nerve shock will receive special consideration at this hospital. It will have its own electrotherapeutic establishment, but will send cases for mineral water treatment to the municipal establishment. It will be staffed by officers of the Canadian Army Medical Corps, but for the special treatment by the mineral water two local practitioners have been given honorary commissions in order that their special experience may be available. I have the honour to be one of these.

For officers requiring treatment special arrangements have been made for their accommodation at hotels, &c., in the town. They receive free treatment at the baths and free medical attendance.

Both at Harrogate and Bath the mineral water hospitals have been largely or entirely given over to soldiers, but as they are both smaller than the Buxton hospital they do not accommodate so large a number of military cases, I believe. In Bath there is also a Red Cross hospital and a V.A.D. hospital; there is no essential difference, I think, between these two organizations; there is also a small hospital for officers. Primarily these hospitals are for cases likely to receive special benefit from the spa in question, but, as in the case of Buxton, wounded soldiers are received as well. A large hospital of 500 beds is about to be opened at Combe Park, near Bath, and staffed by the local doctors, but this will be for wounded soldiers and not for special bath treatment. At Harrogate the Grand Duchess George of Russia maintains a private hospital, and there are also hospitals under the V.A.D. system on the same lines as those already referred to. In the smaller spas the mineral water hospitals are also in use for soldiers, supplemented by small V.A.D. hospitals.

We have no hydrological institutions in this country strictly comparable with those in the States. The so-called hydropathics are often no more than pensions or hotels with a small equipment of baths and simple forms of douche; a few of these have taken soldiers for special treatment, but I cannot give you any details beyond what you will find in the small book published by the Health Resorts Sub-Committee of the Royal Society of Medicine, which you already have.

Yours sincerely,

CHARLES W. BUCKLEY.

France is sending her wounded as far as Biarritz and Nice and the neighbouring Riviera, and we hear that Vichy and Aix-les-Bains are full of soldiers "taking the cure" until able to join the ranks again, if need be. One of the great sources of reputation of Aix was the remarkably good results achieved in affections of the joints and in supplementing the

work of the military surgeon. The soldiers of Napoleon went there, and recovered and fought again in later campaigns.

I have recently received from Dr. Margnat, of Vichy, who is now in command of a field ambulance, a letter in which he describes the efforts which the sanitary corps is making to afford balneologic treatment to the troops in the present War. The spas in France which are receiving sick and wounded soldiers by direction of the War Office are Amélie-les-Bains, Barèges, Bourbonne-les-Bains, Bourbon-l'Archambaut, Vichy, and Plombières. In Algeria they are utilizing Hammam R'hira, Bains de la Reine, and in Tunis, Hamman Lif. In cases where the springs belong to the Government, the soldiers sent for treatment are under the rules in force in military hospitals; but in other cases arrangements are made with the private owners for the use of the establishment as may be required.

At Harrogate there are at present upward of 100 of the wounded and invalided under treatment. These comprise convalescence from gunshot wounds, rheumatism, sciatica, neuritis, dysentery, and similar trouble, and in the winter and spring trench feet and frost-bite. The Plombières treatment is given for intestinal trouble, and in all 15,000 treatments have been given free.

Mineral spring hospitals receive, first, soldiers and sailors on active service; next, soldiers and soldiers on non-active service, either invalided or retired, and, finally, officials in the Colonial, Custom-house, or the Forestry Service. Cases sent for treatment are subject to selection by Army surgeons, and are restricted to those in which ordinary means of treatment have been used during a sufficient length of time without success. They may therefore be considered chronic cases.

At Vichy the thermal military hospital, which is assigned to the soldiers' balneologic treatment, has about 300 beds. It is open from May 1 to September 15. This interval is divided into six seasons: (1) From May 1 to 21, (2) from May 24 to June 13, (3) from June 16 to July 6, (4) from July 9 to 29, (5) from August 1 to 21, and (6) from August 24 to September 13.

The military patients are distributed beforehand between these different seasons; they must all arrive on the same day and leave on the same day as well.

The interval of two days between each period is used for cleaning and disinfecting the hospital.

In the hospital itself there is a bathing establishment where the patients take their cure of baths and douches. Like the patients in civil life, they drink at the "buvettes" belonging to the Government.

The soldiers' cure is directed by military doctors specially appointed by the sanitary corps, but generally not belonging to the station.

With its 300 beds the military hospital in Vichy provides treatment for thousands of patients.

The other stations capable of receiving soldiers have less important organizations, and with the exception of Amélie, which has three, they do not all possess a special establishment for soldiers. Plombières, Bourbon l'Archambaut, Barèges use the civil establishments for treating the military patients.

The treatment at Vichy is indicated for digestive troubles, dyspepsia, rheumatic and gouty gastralgia, enteritis and chronic colitis, liver and spleen engorgements, especially after malaria, hepatic colics, uricæmia, uric lithiasis, gout, renal colics, arthritism, obesity and diabetes.

Barèges and Amélie-les-Bains for old painful wounds,

old fistulous wounds, retracted muscles, old joint diseases, local tuberculosis with no infection of the lungs, indolent ulcer, cutaneous herpetic trouble, inveterate syphilides.

Bourbonne-les-Bains and Bourbon-l'Archambaut for lymphatism and scrofula, chronic rheumatism, sciatica, muscular atrophy, traumatic arthritis, stiffness of the joints.

Plombières for visceral rheumatism, gastralgia, enteric dyspepsia, chronic dysentery, painful engorgement of the liver, painful cystitis, sciatica, neuralgia, traumatic neuralgias.

In the present War the spas have played a very important *rôle*, but at the same time a very complex one. They are serving a useful purpose for the wounded owing to their many hotels, and for their physiotherapeutic resources in the treatment of troubles consequent upon wounds. The thermal military hospitals afford the balneologic treatment proper to each station, so that now soldiers can follow balneological treatments not only in the above-mentioned spas, but also at Neris, Aix, Salies-du-Béarn, le Mont-Dore, Uriage, Luchon, Châtelguyon, Cauterets, Dax, Argelès, &c.

Dr. Margnat says he has no statistics of the results obtained from balneological methods. But from a few particulars which have been procured, balneotherapy, with douche massage and hot baths, has given excellent results in a series of wounds and stiffness of the joints, especially in muscular troubles.

Hypertonic baths, such as those of Salies-du-Béarn, have been extremely favourable to wounds slow to heal, and Neris's hyperthermal baths to acute articular rheumatism.

Vichy, with its extensive bathing establishment (douches, massage, mineral baths, Zander institute), has contributed to the recovery of an incalculable number of wounded.

The *rôle* of the balneologic treatment of troops having

taken part in the War will certainly not be over with the latter. We anticipate an organization after the War which will utilize all resources to remedy as much as possible the diseases and infirmities incident to warfare.

Austrian Facilities.

I am informed that at Karlsbad there are about 3,000 soldiers sick or wounded. Of the medical men usually in practice at that spa only two are reported to be left, and these are over 70 years of age. The use of the baths is probably, therefore, in the hands of attendants or military surgeons.

Dr. Heinrich Kisch, of Marienbad, is credited with having proposed fifty years ago that the Bohemian health resorts should be accorded neutrality in war time. He made this proposal when war between Austria and Prussia was threatened :—

" It was considered at a parliamentary sitting in Prague, December 7, 1866, and the Government was asked to further the project. Count Forgach, then Governor, lent his aid. In August, 1867, there was an international conference in Paris on the aid societies for wounded soldiers. Dr. Kisch sent a pamphlet to all who took part, to persuade them to use their influence in favour of the idea and to decide that a supplementary article should be added to the articles of the Geneva Convention. Surgeon-General von Langenbeck spoke in favour of Kisch's proposal in the Paris Conference, and requested that all health resorts should be regarded as neutral within the area of war.

" During the long period of peace nothing was done about it. In 1912, during the Balkan War, Dr. Kisch took the matter up again. The President of the Austro-Hungarian Association of Health Resorts addressed a memorandum to the Foreign Secretary of State, and asked his support in this matter. Meanwhile, in August, 1914, the great European War broke out. The Foreign Ministry replied that the matter was being given serious consideration. The law of December 26, 1912, permits the utilization of health resorts for military purposes in case of necessity. According to the Geneva Convention of July 6, 1906, military hospitals are protected, as are also institutions in health resorts

which are employed for the military health service. Against declaring health resorts in general as neutral, said a high official of the Ministry of War, there are circumstances which must be very thoroughly considered.

"Dr. Kisch is a man of perseverance, and has not given up hope of being able to realize his idea after the War. He thinks that this War has proved the important *rôle* played by the health resorts in curing wounded and sick soldiers, and that this fact will lead after the termination of the War to repeated negotiation of his proposal. He believes he will live to see his idea accepted. In this case he said to an interviewer that Goethe's words will prove to be true: 'Was man in der Jugend gewünscht, bietet das Alter in Fülle' (That which one has wished for in his youth, age offers in fulness)."—*Journ. Amer. Med. Assoc.*, April 29, 1916.

Bath Trains.

It is interesting to note that bath trains are now used by the armies in the field. These are in use in Austria and Hungary, and also in Serbia; doubtless, also, in Germany and France. They are provided with sterilizing equipment, usually a refrigerator car into which steam is introduced. When baths are required the hot water is obtained from the locomotive. One of these trains has two cars with thirty bath-tubs each, two tank cars to supply the water, one car for undressing, four freight cars with clean linen, a sleeping car for the personnel of the train, and two or three cars for the disinfection of clothing. This arrangement permits 1,200 men in the course of ten hours to take a shower bath and have all their clothing thoroughly sterilized.

Even in the trenches it is possible to have needle shower baths. Cablegrams announce that the Philadelphia Committee of the American Ambulance has forwarded ten portable needle shower baths fighting on the Verdun battle front. They are much in demand, and 150 more are requested. Each bath outfit costs $120, and the needle spray is operated by means of pumps.

Combined Methods.

In addition to hydrologic forms of treatment, well-equipped spas provide massage, local dry heat by means of special electrically heated apparatus, and active and passive exercises by Zander apparatus. Electrotherapy also occupies an important place in the combined method of treatment.

In some of the larger French hospitals, notably the Grand Palais in Paris, which has been converted into a military hospital with 2,400 beds, all these measures are successfully applied. An experienced hydrologist from one of the French spas is in charge of that department. There is also a large out-patient service, where soldiers, chiefly officers, from all parts of Paris are treated; but the reports would indicate that better results are obtained with the in-patients, probably because daily treatment, sometimes extending over months, is required, just as we observe it in the case of physical treatment applied in civil practice.

According to Drs. Fox and McClure, local hydrological treatment is employed in a special manner for wounded limbs, especially for trophic lesions resulting from prolonged suppuration, chronic œdemas, swellings of the peri-articular tissues, and fractures of the articular ends of bones, and painful and adherent cicatrices. Such applications prepare the way for massage and movements, and render them easier and less painful. The arm or leg is placed in a local bath of running water (*balnéation à l'eau courante*). The temperature is hyperthermal, ranging from 40° C. to 46° C. and gradually increasing, and the duration from twenty to thirty minutes. The current is rotatory, of a strength that can be varied at will, and it can also be directed to any part of the limb. Such applications produce extreme vaso-dilatation

and increased arterial circulation. In addition to these familiar effects, which are well seen in the treatment of stiffness and fatigue fever by hyperthermal baths, it is believed that "whirl baths," as they may be called, have a special action due to the movement of the water. The hydromassage, added to their high temperature, appears to have a marked sedative effect in relieving pain, and also promotes the lymph circulation and diminishes the effusions and swellings of soft parts. This form of bath therefore accelerates the retrogression of sub-inflammatory conditions. The same effects are not observed from baths of similar temperature in still water. Whirl baths are now always given before manual or mechanical treatment, and increasing importance is attached to them. At the annexe of the Grand Palais in five months 2,124 preparatory treatments in *eau courante* were given.

American Hydrological Resources.

It occurred to me that we ought to draw some lessons from European experience and make an inventory of our own resources, and at least see where we would stand in case we should be involved in a serious war. Conditions in the United States are very different from those in Europe, where, for the most part, the great spas are owned by municipal or national governments. I asked the Surgeon-General of the United States Army whether the subject of the use of spas for soldiers had ever been considered, and he replied that, as far as he was able to ascertain, no similar arrangement as, for instance, that organized in England had ever been contemplated by the Medical Department.

Aside from the reservation at Hot Springs, Arkansas, which for over eighty years has been owned by the United States, and the wonderful thermal springs of the Yellow-

stone National Park, as yet unprovided with any medical establishment, the Government owns no spas. The State of New York, however, at an expense of over a million dollars, has acquired valuable springs and surrounding property in Saratoga, and is engaged in a praiseworthy effort to equip this spa for the general use of the public. This valuable property is now under the direction of the New York State Conservation Commission, and it is destined, we hope, to have a new era of usefulness.

We come, then, to the privately owned spring resorts where balneologic or hydrotherapeutic treatment, or both, is given.

In Maine we have Poland Spring, twenty-five miles from the sea-board. It has a small hydrotherapeutic department, and it is the only notable spring resort in New England. It has a capacity of about 500. In New York, besides Saratoga, already referred to, we have Sharon and Richfield Springs, Glen Springs, with its special treatment for cardiac cases, and Clifton Springs.

In Pennsylvania, Bedford Springs, about 300 miles from the sea-board; in Virginia, Hot Springs, Healing Springs, and Warm Springs, with a combined capacity of about 1,000, and an excellent equipment for balneologic treatment; the hydrotherapeutic equipment of the Chamberlin at Fort Monroe on Chesapeake Bay. The capacity of this resort is about 500, and it is on Government property. In West Virginia the White Sulphur Springs, thoroughly equipped, and with a capacity of about 1,200. These inland resorts are about 250 miles from Washington and 300 miles from Chesapeake Bay.

In Indiana, French Lick, with a capacity of 1,000, well equipped with bathing facilities. Distance 600 miles from the seaboard.

In Michigan there is Mount Clemens, with numerous bathing establishments utilizing the saline sulphur water. Battle Creek Sanatorium, provided with a complete hydrotherapeutic department. Distance 655 and 791 miles from New York.

In Arkansas there are numerous establishments utilizing the thermal springs and a Government hospital for officers and enlisted men. Distance about 1,000 miles from the Atlantic seaboard.

Still farther west we have Glenwood Springs, in Colorado, and Arrowhead, Paso Robles, Byron and Napa Soda Springs, Paraiso Hot Springs, Klamath Springs, and other minor resorts. It is impossible to mention even the names of others, but they are for the most part open during the summer, and not very extensively or scientifically equipped. These resorts, however, would prove useful in case of operations on our Pacific coast.

It would be necessary in case of hostilities involving any considerable number of troops to have convalescent camps at which soldiers recovering could remain under military supervision until ready to rejoin. Because of expense and difficulty of undertaking long railway journeys, it is probable that the spas near our coasts would play a more prominent part than those far in the interior.

In the United States, as in England to-day, it would be doubtless possible to arrange for the use of privately owned spas for military purposes if that should ever be necessary.

There are some methods employed in European spas not very extensively used in this country. We do not make so much use of mud baths, of inhalations, and intestinal irrigations. These methods of treatment, common in European spas, especially on the Continent, are used to a very limited extent in the United States. Such measures

require a special equipment, and probably will come into greater use in the future.

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Dr. Elliott: In a letter last week Dr. Hinsdale asked me if anything was being done in Canada regarding hydrotherapeutic treatment in the case of returned soldiers. I can speak only of Military Hospital No. 2, where it has fallen to my lot to look after a number of the returned men, and where we have handled perhaps 800 returned soldiers. These are men who are invalided; the acute cases, of course, are not sent home, but are treated in the hospitals abroad. We have a number of county convalescent homes, and the definitely tubercular invalids are sent to the sanatoria. One of our members, Dr. Byers, has a number of them at Ste. Agathe des Monts. In the convalescent military hospital at Toronto we have a hydrotherapeutic room, where we use massage, Swedish movements, high-frequency current, electric light cabinet bath, needle showers, &c., and in the class of cases I have seen, more particularly in the pulmonary cases, we have found hydrotherapeutic measures very useful in the intercostal neuralgias and chronic pleurisies which many have developed as the result of lying wounded on the field for one or two days before receiving aid, and in patients recovering from pneumonia; also in some of the fracture neuroses, the traumatic neuroses from shock, where the men have been subjected to the shelling of high explosives, producing a fracture neurosis, and possibly, in some, a condition of hyperthyroidism, it is hard to tell just what. The condition has been made more obscure by the showering upon these men of tobacco. It is said that in some hospitals they have had little treatment but rest and tobacco, and a number of these men with high blood-pressure have improved very decidedly after giving up tobacco. Many of the cases of hypertension

have improved very decidedly with the use of the high-frequency current. Hydrotherapeutic measures have been of benefit in some cases of myositis, firobsitis, or painful scars. A number of the soldiers have come back with bad mouth conditions—bad teeth, pyorrhœa, &c.—and in these cases the high-frequency current has given very good results. But the traumatic neuroses and psychasthenias, particularly sleeplessness, some of the cases of high blood-pressure and tachycardia—these conditions have responded splendidly. The patients are as far as possible allowed to go to their homes and come as out-patients to the hydrotherapeutic department, but in cases of tachycardia or hypertension they are made to rest in the institution.

THE ADVANTAGES OF SPECIAL TRAINING IN TUBERCULOSIS IN SANATORIUM SURROUNDINGS.

By EDWARD R. BALDWIN, M.D.

SARANAC LAKE, NEW YORK.

I AM confident that no one in this society would gainsay the fact that there is a steadily increasing number of physicians who are known, or call themselves, tuberculosis specialists. I mean, of course, those usually modest individuals who, generally because of ill-health themselves or in their families, become identified with this field of medicine. These form by far the greater number, and they usually inhabit health resorts or become connected with some tuberculosis institution.

There has been no great enthusiasm in the past on the part of other physicians to engage in the special work of treating tuberculosis unless they were downright charlatans, like the cancer quacks, or were honest but deluded individuals, who believed that they had the right "theory" of treatment or the best remedy, if not the only cure. I say that this condition has existed in the past, but there is a rapid change taking place owing to the well-organized anti-tuberculosis movement and the rapid multiplication of dispensaries, sanatoria and new health resorts. Public and private sanatoria are being established, and a demand has been created for trained men to take charge of them.

The supply of broken-down doctors, competent and willing to take up this work, is being used to the utmost

The specialty of tuberculosis or phthisiotherapy is an accomplished fact; it has already been recognized as such in a few medical schools, and doubtless will be soon by many others. If gastrology, dermatology, or even proctology are entitled to recognition, no one with justice to its importance can deny tuberculosis a place on the curriculum. The reasons why the matter has been neglected are various, but one was the feeling of hopelessness in the past of any but palliative treatment; therefore, why should we take much notice of it? Further, the clinical study of the disease had to be made on far-advanced cases, thus making anything but encouraging impressions upon the students.

To a large extent these reasons exist to-day; they are less prominent, but it is rare to find a teacher of physical diagnosis—for example—who takes an interest enough in tuberculosis to stimulate his students to follow up the patient from clinic to sanatorium or hospital. I know there are exceptional men who do this and more, but it is probably becoming more and more impracticable with the development of the institutional care of tuberculosis outside of medical centres, which are generally in large cities.

When an early diagnosis is made, an effort is now made to get the patient into a sanatorium for awhile at least. This is the rational thing to do.

The consequence is that the place where the disease can best be studied is in the sanatorium. Moreover, the men who live with the patients, often themselves patients, are much better interpreters of the disease than those who have only the academic attitude to it of teachers. Even though they are most interested and enthusiastic teachers, they cannot carry the weight that the man does who has personal experience with the disease or lives among those who have it. (I would not safely carry the parallel so far as to say

that the man who was a bit queer and had lived in a lunatic asylum was the best teacher of the insanity specialty, but even this might be true of some brilliant exceptions!) Yet, I submit, the proposition is a correct one so far as tuberculosis is concerned, provided there are teachers to be had of sufficient skill and experience.

Now the present undergraduate course in the best medical schools is being crowded with necessary fundamental studies, which of necessity become more detailed with the advances in medical science.

The average student has nearly all his attention occupied, with so little time for any special subject that it is too much to expect a really advanced course of instruction in tuberculosis. Very much more is being done than formerly, and very much better training for diagnosis and the management of tuberculous patients is now available, yet we do not find that it has brought about a revolution in the care of these patients by the recent graduates. It is not all the faulty or insufficient training that is responsible for this, but I suspect that they took but little interest in this disease while in college. The subject has had no real appeal to them, while so many interests filled their time that were stimulating because spectacular or unique. Then the routine practice among the tuberculous was discouraging and the home treatment difficult, and favourable results only temporary.

There are probably several reasons other than the ones I have mentioned, but these are some that have been given by physicians of my acquaintance.

It appears from many standpoints that to get a proper perspective of the disease a special study ought to be made under the most favourable surroundings, where an atmosphere of hopefulness prevails among the physicians

as well as the patients. This means for the most a post-graduate course of some weeks, where a more intensive study of suspected early cases, the observation of the various symptoms, and the use of the most approved methods of clinical and laboratory diagnosis can be had.

We all know that there is no longer the excuse for the neglected examination of the sputum, but we also know that the time has come when the physician is called upon to find the disease before the sputum is positive, and even when there is no sputum. This means a refinement of technique or of physical examination not yet attained by many. Then there are laboratory experiments and observations that give much help to a proper understanding of the symptoms and pathology of tuberculosis.

Under such conditions it is probable that the study of tuberculosis can be made a really vital interest for those who will have opportunities to use their knowledge (and what general practitioner of the better class would not?) for the benefit of their own community. Where such facilities as are above outlined can be had, it is not unlikely that the present demand for advanced study of tuberculosis will result in the formation of graduate courses along these lines.

While the late Dr. Trudeau was still living, a Cleveland gentleman, well known for his generosity and interest in medical education, became interested in this subject through his son-in-law, who was at that time at the head of the Cleveland Tuberculosis Institute. This gentleman offered a fund towards the support of a post-graduate school at Saranac Lake for three years, which the trustees of the Trudeau Sanatorium accepted.

The experiment will be made to give a combined clinical and laboratory course in the art of diagnosis, treatment by sanatorium methods, and the organization and management

of hospitals and sanatoria, both public and private. The first trial will be six weeks. For those who contemplate city, county, or state institutional work, the Ray Brook State Sanatorium will furnish facilities for study. It is also proposed to combine these courses with studies of the municipal dispensaries for those who expect to go into public health work in tuberculosis. The first session of the "Trudeau School," as it is to be called, will be given this spring. If the experiment receives encouragement, and is found to be useful to the cause, it will probably become a permanent adjunct of the sanatorium work in the Adirondacks. The co-operation of several private institutions is promised, and the facilities of the laboratories for research will be offered to those who wish to do more advanced work of that kind.

A Foundation for research and teaching to the memory of Dr. Trudeau is now being raised to further this project. The friends of Dr. Trudeau have already responded loyally, and the sponsors for this effort bespeak the interest of all those who would see his institutions perpetuated. In an environment such as Dr. Trudeau created there is much that has made life interesting for the medical victim, as so many members of this society know from actual experience. Among the objects stated in the appeal for the Foundation is the establishment of Fellowships for young physicians who, because of ill-health, desire to engage in this field of research.

In the minds of those familiar with the subject there is no better way to further our knowledge of the disease than to get those who are most interested in this personal way to make it a life-study. To this country the world will look for advances in medicine more than ever, and for a long time to come the Old World bids fair to be crippled, its

laboratories closed or given over to routine work made imperative by the War. We must realize this responsibility, and take up the problems with a sense of duty as well as of the privilege that is given to us.

DISCUSSION.

Dr. OTIS: I should like to say in regard to Dr. Baldwin's paper that it brings up an interesting point—that is, the utilization of the State sanatoria, not only for advanced work, but as a school for the general practitioner. In many States members of the local boards of health come together at the State capitol once a year for a number of days to receive instruction and gain experience through talks and lectures in regard to their duties. On the same idea it seems to me that the State sanatoria might be utilized for the instruction and training of the general practitioner in the diagnosis and treatment of tuberculosis. A week, for instance, might be set aside by the State sanatoria, accommodations given, and a certain number of general practitioners invited to spend that length of time there in intensive study and observation of cases. It seems to me that the State sanatoria could well utilize their enormous and valuable clinical material in this way, which so far as I know has not been done in any State. In Massachusetts, for example, where there are four State sanatoria, it would be perfectly possible to gather together groups of physicians from various sections of the State and let them reside at the sanatorium for a week and study and observe the cases under the instruction of the resident physician. I believe that this would have a general good influence in promoting a greater skill in diagnosis for the general practitioner, for, after all, it is the general practitioner in the community and the country at large upon whom we must depend for the early diagnosis and treatment of tuberculosis. I throw out this point, as it seems to me of value. I believe that with a small additional State appropriation such schools at the sanatoria for intensive study for a week could be instituted and would prove extremely valuable.

Dr. ROCHESTER: There is one question I should like to ask Dr. Baldwin. He spoke of teaching in connection with dispensaries. Have they any facilities for dispensary teaching at Saranac? Or have they any means of using the dispensaries of the State in that connection? We find in Buffalo that the tuberculosis dispensary is of great value in teaching our students. We send them there in groups. There they examine patients for suspected tuberculosis and see many incipient cases. I have wondered whether there were any such facilities in connection with the school at Saranac.

Dr. BALDWIN: In regard to Dr. Kleb's suggestion as to the teaching of industrial occupations in connection with sanatoria, this is to-day very much neglected in this country. We have in the course of organization three different features which might be mentioned. First, the workshop at the Trudeau Sanatorium which is not really self-supporting but which is well patronized by the patients. There they have all the arts and crafts—photography, picture-frame making, wood carving, basketry, and to some extent iron work. It is intended, however, as Dr. Brown originally decided when he made his appeal for it, more as an amusement and occupation for the patients than for profit. Then in the State sanatoria a good deal of work is being done by the patients; that is, much of the routine work of cleaning the rooms, making beds, &c. And then at Stony Wold Sanatorium the patients do a certain amount of room work, of laundry work and darning, and an agricultural experiment has been attempted, which they hope to develop, but in the Adirondacks the country is not very favourable for any great agricultural effort. There are great possibilities of future development in this connection, but in our vicinity the people remain for very short periods as a rule, and to carry out any industrial work which would amount to anything might require a very different plan than exists now in the State or private institutions. As to the utilization of the State sanatoria, I might say that Dr. Garvin, who is the head of the New York State Sanatorium, has for some years adopted a very excellent plan. Physicians who care to do so may become his assistants, and he will give them every opportunity for examining suspected early cases, classifying and teaching the routine of the work. This has already accomplished a great deal, and the idea will be elaborated still further. But Dr. Otis's idea of teaching is one that certainly needs to be developed. In regard to our particular work, we feel that if we can take care of and educate a small group of men and give them for six weeks opportunities for intensive study, we can do more than if we tried to take a large body of men, giving them only a smattering. I might say that we have a number of applications from men who would like to come and spend a few days with us and learn all about tuberculosis. That sort of man is not for us, or for any institution. The dispensary feature has not been overlooked in this scheme. Dr. Bishop's real idea in promoting the Trudeau school was to get hold of men trained to do work in the dispensary. An arrangement has already been made with the large dispensaries in New York, Philadelphia, Boston, and Cleveland, whereby they will co-operate. Men who desire to go into municipal or institutional work will have this six weeks' course first, and later if they wish to enter as assistants in any of these dispensaries; in fact, most of the dispensaries are very anxious to get these voluntary assistants.

THE RÔLE PLAYED BY THE STUDY OF TUBERCULOSIS IN THE DEVELOPMENT OF CLINICAL MEDICINE.

By H. R. M. LANDIS, M.D.
PHILADELPHIA.

Since the study of tuberculosis in the past has led to some of the most notable contributions to our knowledge of medicine, it is certainly a subject worth our while to inquire into. Especially is this true when we consider the apathy with which the subject of tuberculosis is viewed by many into whose care the teaching of students is entrusted.

As one glances over the list of distinguished clinicians who lived during the past century, it is noteworthy how many of them were keenly interested in this subject. The names of many such will recur to your minds. It is not my purpose, however, to give a complete list either of eminent students of tuberculosis or of the many notable papers which they contributed. On the contrary, I purpose confining my remarks to those studies of the disease which, in all truth, may be said to be epoch-making.

The first contribution to which I wish to call your attention is that by Auenbrugger on "Percussion of the Chest." The "Inventum Novum" was first published in 1761 and forgotten for forty-seven years, when it was translated from the Latin by Corvisart, physician to the first Napoleon, in 1808. To the translation Corvisart added personal observations, and by his enthusiastic endorsement of the method firmly established its status. Now while it cannot be claimed

for Auenbrugger's work that it represents a special study of phthisis, it is apparent on reading the "Inventum Novum" that the major portion of his observations was based on the various manifestations of this disease.

Walsh has pointed out that respiratory diseases, particularly pulmonary tuberculosis, have always been very prevalent in Vienna, and that in Auenbrugger's time there must have been practically unlimited opportunity for the study of pulmonary diseases of all kinds. As a matter of fact, the observations of both Auenbrugger and Laennec were made on exactly the same sort of clinical material. They were both studying advanced cases of tuberculosis in the hospitals of a great city.

Important as Auenbrugger's discovery was, it becomes overshadowed when compared with the immortal work of Laennec. When, in 1819, Laennec gave to the world the stethoscope and his observations on mediate auscultation and the pathological anatomy of diseases of the lungs, he practically created clinical medicine as we know it to-day. Furthermore, "to Laennec will for ever belong the honour of having fixed definitely the clinical picture of the disease (tuberculosis), and of having separated it by means of auscultation, and his pathological studies from all similar affections of the lungs" [5].

In this instance it may be objected also that the work on mediate auscultation does not represent a special study of tuberculosis. Strictly speaking, this may be true, but it is equally true that Laennec's observations were based largely on the manifestations of this one disease. In his search for the various phenomena which might be detected as the result of pulmonary disease, it was inevitable that phthisis, which at one time or another presents almost every conceivable pathological alteration in the lungs, would

occupy a large share of his attention. This was unquestionably true, and to his constant association with individuals suffering from the disease, and at a time when preventive methods were unknown, may be found the source of his own infection.

He himself stated that "affections of the organs contained in the cavity of the chest are indisputably the most frequent of all local diseases; indeed, there is no other tissue in the animal economy, the idiopathic and primary inflammation of which becomes the cause of severe disease, or of death, so frequently as that of the lungs; nor is there any so liable to be the seat of accidental productions of every sort, more especially tubercles, the commonest of all" [2].

The estimate of Laennec's work as given by Addison stands unchallenged even to-day: "Were I to affirm that Laennec contributed more toward the advancement of the medical art than any other single individual, either of ancient or modern times, I should probably be advancing a proposition which, in the estimation of many, is neither extravagant nor unjust. His work, 'De l'Auscultation médiate,' will ever remain a monument of genius, industry, modesty, and truth. It is a work in perusing which every succeeding page only tends to increase our admiration of the man, to captivate our attention, and to command our confidence" [1].

The work on "Mediate Auscultation" should be read, I believe, by every student before his graduation; not only because of its great historic value, but because the observations it records were so thoroughly and so accurately done that little of importance has been added. Furthermore, he would find "much that would clear the confusion regarding physical signs which teachers to-day discuss without even referring to the observations of this master

mind." "Let the student become familiar with all that is now known on this subject, and he will read the writings of Laennec with amazement that there remained so little to be altered or added" (Austin Flint).

An invaluable addition to our methods of investigating disease is what is known as the numerical method. For this we are indebted to Louis, and it is of interest to recall the fact that his work on "Phthisis" was the first which exemplified the numerical method of investigation. This celebrated work appeared in 1825, and was the outcome of five years' hard work in the wards of La Charité. It stands to-day a brilliant testimonial of the value of his careful anatomical and clinical observations, as nearly all of his conclusions have been confirmed by the researches of others who repeated his labours.

The numerical method has for its object the correlating of all the facts which may have any bearing on the disease under investigation—the circumstances under which it occurs; the type of individual especially liable; the character of the symptoms and the frequency of their occurrence; the constancy with which pathological changes are associated with certain symptoms; and, finally, the result that this or that method of treatment exerts on the course of the disease.

Cowan, in his introduction to the English translation of the work on "Phthisis," remarks that: "It will at once be perceived that certain laws require for their elucidation a larger number of examples than others; where 100 observations may in one case be sufficient, three times that number may be required under other circumstances. Were we, for example, analysing 100 cases of pleurisy, the value of any symptom invariably observed would be considerable, and perhaps sufficiently established; but were it only present twenty times out of that 100, its real

importance would be much less positive, and require an additional number of facts for its determination."

It was by means of this method, for instance, that it was established that phthisis invariably starts in the upper lobes; that simple bronchitis pursues a course inverse to that of phthisis; and that tubercles in any organ of the body, after the age of 15, involve their presence in the lungs.

It is difficult to conceive of a time when such a simple and obvious method of studying disease was unknown, and yet it was only because Louis possessed the courage to continue his labours in the face of scepticism and ridicule that he succeeded in establishing the truth of his assertions. Cowan has well described this period in Louis' life: "For some time his extreme minuteness of inquiry and accuracy of description were the subjects of sneering and ridicule, and '*Cui bono?*' was not infrequently and tauntingly asked. The absence of any immediate result seemed for a time to justify their contempt of a method, involving too much labour and personal sacrifice to be generally popular or easily imitated; and M. Louis himself at moments almost yielded to the increasing difficulties of the task he had undertaken. No sooner, however, were his facts sufficiently numerous to admit of numerical analysis than all doubt and hesitation were dissipated, and the conviction that the path he was pursuing could alone conduct him to the discovery of truth became the animating motive for future perseverance. Many of the results to which he arrived soon attracted general attention, and among those who had formerly derided his method, while they admired his zeal, he found many to applaud and a few to imitate."

It is to the great glory of American medicine that in Austin Flint she has one who was no unworthy associate of the men whose work I have briefly reviewed. Of him

Sir William Osler has written: "By far the ablest and most scientific of American students of the disease (tuberculosis) was Austin Flint, whose contributions to the physical signs and the symptoms were among the most important of his many clinical studies" [3]. He was entirely American, and owed nothing to a foreign training. He "found his opportunities in country practice, in Buffalo and Louisville, then frontier towns, and in New Orleans, and had a national reputation before he reached New York." An untiring energy, keen powers of observation, and an almost unerring judgment as to the possibilities of innovations combined to establish him as the greatest clinician this country has yet produced. An unbounded admiration for him tempts me strongly to go more into detail as to his service to clinical medicine, but time does not permit.

Early in his professional career he began his observations on tuberculosis, and his interest in this disease continued unabated throughout his life. He himself states in the introduction to his monograph on "Phthisis," that "of the cases of phthisis which had come under my observation up to the time of entering these studies (1875), I have preserved notes of a considerable number—namely, 670. These cases were noted during a period of thirty-four years. For twenty-five years I made notes of nearly all the cases which I observed, both in private and in hospital practice." In another place he states that he was led to prosecute his study of the disease in order to establish more firmly the relationship between physical signs and the associated anatomical lesions.

To Austin Flint belongs the distinction of making the only addition to Laennec's work which could ill be dispensed with. I refer to his contribution on pitch in percussion and

auscultation, a point to which Laennec paid no attention. His observations were embodied in an essay entitled, "Variations of Pitch in Percussion and Respiratory Sounds, and their Application to Physical Diagnosis," which was awarded the annual prize of the American Medical Association in 1852. This essay possesses an additional interest, for in it he describes the physical signs of incipient tuberculosis, and at the same time points out the necessity of early recognition of the disease if a cure is to be expected. While a prolific writer on all phases of clinical medicine, his reputation has endured largely because of his contributions to our knowledge of physical diagnosis, a large portion of which was the outcome of his study of tuberculosis. Shortly after his death one of his most distinguished contemporaries, J. M. Da Costa, said of him: "With, perhaps, the single exception of Rush, there is no man who, in his many-sided capacities of teacher, author, and investigator, has had thus far as much influence on the medicine of this country as Austin Flint."

March 24, 1882, marks an epoch in modern medicine, for it was on the night of this date that Robert Koch presented to the Berlin Physiological Society his memorable contribution on the etiology of tuberculosis. In our admiration for this brilliant achievement we are apt to lose sight of the fact that in this study, which led to the identification of the tubercle bacillus, an even greater truth was established. What are now known as Koch's postulates were presented at this time in their final and lasting form, and upon these basic principles has been reared the modern science of bacteriology. Here again the intensive study of one phase of the tuberculosis problem led to far-reaching results which have been of incalculable value to clinical medicine.

The facts which I have so briefly touched upon are the

products of intensive studies by individuals. In what I am about to relate it is not possible to attach to any one individual the credit for far-reaching reforms. The first of these relates to treatment. "The nineteenth century," says Osler [4] "witnessed a revolution in the treatment of disease and a growth of a new school of medicine. One of the most striking characteristics of the modern treatment of disease is the return to what used to be called the natural method—diet, exercise, rest, fresh air, and bathing. For the most part these natural methods were first applied in the treatment of tuberculosis, but more and more other diseased conditions are being treated by the so-called hygienic and dietetic method. Furthermore, the laity are becoming more and more conscious of the value of fresh air, exercise, plain food, and the importance of hygiene in general."

At the present time we are passing through another revolution—namely, that which relates to public sanitation. Much of the work now being done on sanitation has had its incentive in the modern crusade against tuberculosis. Housing reforms, improvements in factory conditions, supervision of the health of workers, school inspection, open-air schools, and the crusades against the social diseases, infant mortality, &c., all may be traced, directly or indirectly, to the tuberculosis crusade. Indeed, it is probably not far from the truth to state that the by-products of the tuberculosis crusade have exceeded in importance the original work itself.

I am conscious of having dealt with this subject superficially, and possibly have omitted reference to work which merits recognition. I believe sufficient data have been presented, however, to justify the claim that tuberculosis is as deserving of intensive study to-day as it was in the past. Granting that nothing new may be discovered, it is none

the less true that a study of the various aspects of this one disease cannot but prove to be a profitable undertaking.

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DISCUSSION OF PAPERS BY DR. BALDWIN AND DR. LANDIS.

Dr. OTIS: What I might have to say in regard to the paper by Dr. Baldwin I have already spoken. I shall simply say here that there is an opportunity in the State sanatoria for the education of practitioners who have not had any special training in tuberculosis. We hope that by the better education of the medical student that class of practitioner will gradually disappear, but at the present time there are many practitioners scattered about through our villages and towns who still have much to learn about the diagnosis of tuberculosis; and I think the opportunity should be arranged for these men to come, at a slight expense, to the State sanatoria, where intensive work could be given by the trained assistants. Such sanatoria would be doing a very important work. With regard to the excellent paper by Dr. Landis, I should like to recommend, as he has, the marvellous book published half a century ago by Dr. Flint. The wonderful way in which he classifies his cases over and over again to illustrate one point and another is extremely interesting. I had not realized that the only treatment for tuberculosis fifty years ago was cod-liver oil and whiskey. The amount of whiskey a patient could take, and not be killed, is remarkable; in some cases one to two pints a day, or several times a day, were given. And that with his characteristic care and anxiety Flint sums up the treatment and wonders whether or not the cod-liver oil or whiskey has been of any great value. There are three classes, it seems to me, that now require special training in tuberculosis. First, the class that Dr. Baldwin has already referred to, those who will be specialists in one way or another, as practitioners or physicians in sanatoria; and for such there is the Trudeau School and also in many cases the State sanatoria. Then there is the class of the general practitioner who requires further instruction in the diagnosis and treatment of tuberculosis. The third class, of course,

are the students, who, it is demanded now in our medical schools, shall have special training in tuberculosis. I believe there should be a department under the unit of internal medicine for special work in tuberculosis. In my own work, which I have been conducting for fifteen years, I have the students of the third and fourth years, and, as in practically all teaching in internal medicine to-day, the work is done with small sections. The several dispensaries are utilized, and the students are sent in sections to one dispensary or another. I believe that the dispensary is far better than the tuberculosis hospital for teaching tuberculosis, for there you have always a new problem to set before the student. And at the present day when so much insistence is placed upon laboratory instruction—in which we all concur—I think that one point is overlooked, and that is, that the student shall have some knowledge of logic and some power of deductive reasoning. I find this a fault with many of my students, and unless they possess these two qualifications, no matter how much laboratory training they have, they will not make successful practitioners in tuberculosis, or in any other department of internal medicine. Another point in teaching is the great importance of insisting over and over again upon the proper interpretation of symptoms. The most we can do in the time we have with our third and fourth year students in a medical school is to give them a general idea in the summing up of symptoms; and more stress must be laid upon the question of symptoms in the early diagnosis of tuberculosis if you expect the students to make any great progress in physical diagnosis. It takes a longer time than we have with our students to make a careful physical diagnosis anywhere approximating that of the specialist. It seems to me that stress has got to be laid upon the symptoms rather than on the physical signs.

Dr. JACOBI: I hope there are some practitioners here—I have not heard the name "doctor" in any of the addresses we have been listening to. I am a doctor, and if there are any more here I should like to say something to them. I shall be very brief. I have had many years in which to learn, and I hope to live just another year or two to learn a little more. Meanwhile I want the doctors to learn something from me that I have not heard expressed here this morning. I have followed the sanitarium—or, as some say, sanatorium—movement in the State of New York, and so far I believe I have picked up something; but I have not found that some doctors in the sanatoria have picked up medicine at all, unless it is the medicine which has been promulgated here this morning. Even the subject of sewers has been introduced—and I have felt rather offended, because some twenty years ago I read a paper before the Congress of American Physicians and Surgeons on sewer gas, stating at that time that sewer gas was not as dangerous as it was given credit for. At that time, and I am sorry to say even now, sewer gas was charged with causing and transferring

diphtheria, scarlet fever and what not. I went against that view in my paper, and with a certain success but only a certain success, because our profession is very slow in learning. Sanatoria will not do much good unless the doctors in them know something about medicine and medicines—singular and plural. That is what they have not learned. We have been told by Dr. Otis that what doctors should learn are purely symptoms. The symptoms we should learn about are those which should be treated medicinally and otherwise. If the practitioner can cure a tuberculous patient that patient may remain healthy; but many of the symptoms are neglected, and that is why in two years, or two weeks, the patient is sent to a sanatorium. At least, that is my understanding and my experience. I have a great deal to do with tuberculosis, but almost exclusively among the poor and middle-class—more among poor people even than with the middle-class. Very probably you doctors here have only millionaires for your patients, and you send them away to Egypt or to Florida in their own automobiles. I cannot do that with my patients. But do not forget that most of our tuberculosis is found among the poor, and that they distribute it among your millionaire class. I want to say something in regard to medication. I do not believe that our sanatoria do all they should for their patients unless they use medicines. I do not sneer at cod-liver oil; instead I recommend it for every tuberculosis patient during the winter months not in summer. I have used it for sixty years, and I repeat that I recommend it now—unless I am frightened away by the results of the Prussian War, which has so increased the price of carbonate of guaiacol that no poor man can afford to pay for it. Then there is something else that I insist upon in every one of my cases of tuberculosis—in a sanatorium or returned to me, whether they have returned from Otisville or otherwise, some even from Saranac. I know that in many of these places the rule is no medication. But unless you relieve symptoms you will never cure tuberculosis; unless you give these patients good nights you will never cure tuberculosis. When a man gets no sleep through a whole night he will be worse next day, and will remain worse at least for a week. That man should have an opiate— he must not be allowed to suffer from insomnia. Nor must he be allowed to cough a great deal. I repeat, if you do not give the necessary medicines, every day if needed, the patient will be worse in spite of your sanatoria and in spite of your superior doctors in the sanatoria. There is something more I want to recommend. I have talked a great deal in my lifetime and undoubtedly have called your attention to it before. I do not treat any tuberculosis patient, and have not for fifty years, without feeding him on arsenic in moderate doses that he can take every month in the year and for years to come, and these patients have done well with it. I do not say that I do not send patients to sanatoria; on the contrary I do send them there, but I always say to them, "Continue your arsenic." In a great many sana-

toria they are told, "No medication whatever." You have all had that experience. The fact is they are told they must rest. But most of these patients cannot rest; most of them, except those who pay large weekly sums in a sanatorium, have no rest; and if they have rest in body they have no rest in mind, in thinking of their families, who must lose their support while they are in the sanatorium. I have mentioned this before, and I mention it again. I want you to remember the nutritive and anti-neurotic effect that arsenic has on those whose nutrition has been reduced, particularly in chronic tuberculosis. I have *not* found that arsenic cannot be given when tuberculosis is attended with fever. Even there it can be given. But in chronic tuberculosis it is the thing which should be used month in and month out. I do not say that I do not appreciate everything that is being done in the schools and sanatoria, but I want my students to know things that are neglected, as a rule, in the schools and in most of the sanatoria.

Dr. FLOYD: I may say that at Harvard Medical School there has been made a beginning along the lines suggested by Dr. White. There is offered to the fourth-year men a series of lectures, taking up separately a single disease, and calling in to give these lectures men interested in that particular disease. For instance, last year the course began with the subject of tuberculosis. Each side of the disease was developed and all phases were discussed the sanitary phase, the home treatment phase, the dispensary phase, and various methods of diagnosis. It seems to me that this is a step in the right direction, and I know from talking with the men that it is greatly appreciated, and that their knowledge of tuberculosis, as well as of other diseases, has been largely rounded out by what they have received in this way.

Dr. SCHAUFFLER: I want to emphasize some of the things that President Farrand has spoken of in the education of sanitary officers and health officers in the various states. In New Jersey a law was passed five or six years ago that no one should act as health officer or health inspector unless he could pass a State examination. While I have held no office since then, I thought it would be a good thing to get a certificate. I went up to Trenton and took the examination, and fell down on plumbing. I went again in six months time and passed as health officer. Not only physicians but laymen must take this examination. There is no education in New Jersey leading up to it—a man has to pick up what he can from the pamphlets of the Department of Health—but he has got to pass the examination. This is a step in the right direction. I wish also to mention a federal movement which helps a little, and which provides that every military officer in the United States must take a six months' correspondence course, followed by a written examination—and, as you would naturally infer, a great deal of this work is along sanitary lines. It is one incentive for the medical officers in the Militia, especially in the National Guard, to do good work. But what we need more than anything else are centres in

the various states where the men interested in sanitary problems, where the medical inspector—and in New Jersey it is obligatory that every district in the State shall have a qualified medical inspector of the schools—may get a proper education.

Dr. WHITE: I am sorry that I have not heard these two papers, but there are two or three phases of the subject which I wish to present. First, in relation to our criticism of the medical profession in general—most of the criticism is based on no fault of theirs as a rule, but on the educational institutions which taught them. In those institutions the question of medical school schedules is a serious one. This question is a fundamental one, and one which should be handled very carefully. The apportionment of study hours on the basis of the importance of the disease to the human race seems to me a fairer one than the apportionment on the basis of the importance of the man who happens to be interested in a special field of work. I believe it will become necessary for those who are interested in medical education to rearrange the schedule on the former basis—that of importance of disease to the human race. The National Association for Prevention of Tuberculosis last year made a plea to the Association of American Colleges that tuberculosis be put upon the schedule as a prescribed course on the basis of its importance to the human race. Other organisms of the greatest importance and requiring the same consideration and respect are the *Spirochæta pallida*, the pneumococcus, the gonococcus and some others. Another fault is that we have not yet learned to present these subjects as disease entities. We send the student on from bacteriology and pathology to his subsequent years to meet a varient group of practitioners and clinicians, all of whom give him slightly different ideas of the tubercle bacillus as an invader of the human body and methods of cure. But it seems to me that the day will come very soon when, having apportioned our schedule on the importance of the invader, we will bring the subject together from all sides, from the anatomist and the physiologist to the specialist, presenting every phase of tuberculosis—for example, taking as long as is necessary to get a clear conception of the problem under study from all sides, including the sanatorium side, the home treatment side, and the dispensary side. A correlation presentation of all the phases of the disease in the amphitheatre so that the student will come out for the first time in the history of medicine with a conception of a disease entity. Another feature in the problem of medical education is the production of men for various duties. To-day we drive all through a common mill with the one object of crowning them with a degree licensing them to practice a profession. When they leave the medical school they burst like a shell into parts of very different character. Some become general practitioners, some of the richer class, some of the poorer class, some become laboratory men, and so on. We have not yet attempted the problem of dissociating our teaching groups,

In the medical school it seems to me to-day to be just as desirable for the student to choose his ultimate as it is for the student in the high school to choose his ultimate before having his studies and his course delineated. There will be then a compulsory education in medicine and an elective system dominated by the ultimate with which a man chooses to crown himself for his life's work. I believe that in the lifetime of all of us the demand for various kinds of practitioners in the United States will be determined, and through some such agency as the Carnegie Foundation, or possibly the Federal Government, there will be provided medical educational institutions of varying types to provide and furnish the supply for the demand of these various kinds of people interested in medical service. I do not think the day is very far distant when we shall have in all educational work a unit of equipment for a unit of population and the supply in educational institutions for the furnishment of this equipment. The ultimate aim, of course, will be to provide from Atlantic to Pacific a uniform medical service, so that all classes shall have available a medical care of a uniform character. For it has within a few years become just as important to handle uniformly the universal problem of public welfare as it has become to uniformly provide for the problem of compulsory education.

Dr. LYMAN: I want briefly to call attention to one movement that to my mind is a very distinct advance in the effort to reach the general practitioners and interest and educate them in the problem of tuberculosis. Dr. Otis has said that we should get them to come to the sanatoria and work with us there. This would be extremely valuable, but they will not come. One will occasionally come, but the rest are not interested, or a great many are really scared to come. In the State of Virginia they have recently started a movement which I think is of great importance. They purpose to send notices to the doctors in the various towns of the State saying that on a certain two or three days Dr. Lloyd, the Physician-in-Charge of the State Sanatorium, will be in that town, and that through him the State of Virginia will be very glad to furnish to any of the physicians of that town free consultation in any of their cases for which they desire special advice or are unable to secure consultation. This will accomplish two things—it will help educate the physician in the diagnosis of tuberculosis, and it will put the services of a skilled consultant within the reach of patients who otherwise have no chance of a diagnosis until their disease was too far advanced for cure. This, I think, is a very important movement and one that other States could profit by.

Dr. LINSLY WILLIAMS: I was very much interested in what Dr. Farrand had to say in regard to public health education—of the need of education of physicians and others to hold public health positions. Some years ago a committee was appointed in New York City to make a study of conditions affecting public health. The law provided then, as it still does, that every health officer should be a physician. There

happened to be 1,443 different municipalities in New York—in cities, towns, and villages—and when one began to investigate the character of physicians that acted as health officers it was soon found that many were incompetent as modern health officers and also rather incompetent as physicians. But this is readily understood when it is realized that some of these men, perhaps over half of the 1,000 health officers, live in rural townships, where they are the only physicians and where they do not get away from one year's end to another, and then only when required by law to attend a sanitary conference, which for many of them has been nothing more than a two or three days' junket and an opportunity to swap stories about the "sewer gas." In 1913 a new law was adopted which provided for the appointment of a public health council of six members, who should have power to enact sanitary regulations and to supervise qualifications of health officers in the future. It is most important to educate these health officers, not only as health officers, but as physicians; and the Council has required that after 1916 every health officer shall have had some training and experience—they must have had some experience in public health administration or have taken some course approved by the Council, which has approved such courses as those at Harvard and Pennsylvania—although, I may say, we have not as yet found any health officer who desired to take those courses. But the Council also approves a correspondence course of six months, followed by a six days' residence course of laboratory instruction or a six weeks' residence course. We have been fortunate in getting, without much pressure, over 200 of the 1,090 health officers—nearly one-fifth—to take this course; and it is encouraging to notice the interest of these men—many of them men with long white beards—men you never see at a medical meeting, who have thought they needed no additional instruction—after they have taken this course for one month, after they have done twenty to thirty hours' reading, it is refreshing and encouraging to see the interest and enthusiasm they have for something that is new and will be helpful to them not only as health officers but as physicians. I speak of these things in this detail to show you that the question of the physician in the rural community is a serious one. Another important consideration for the health officer is in regard to his having more and more work thrust upon him. He receives no compensation to speak of; he receives in his rural community $50 to $75 a year for his services as health officer, and if he does not do his work well the Commissioner of Health has the power to remove him for inefficiency. But if there happens to be no other man in the community to take his place, we must use this man or go without; and the people in those towns must get some protection. Another thing which has helped very much is the appointment of a medical supervisor who will supervise the work of the health officers; and after some two years' work with these supervisors we have sixteen very excellent men who have acquired definite information as to health problems. But the Legisla-

ture, in its extreme wisdom, has cut off the payment of some of those men, so that instead of having twenty we will only have ten; but this still helps materially and will be a considerable educational factor. In closing, I wish to emphasize the fact that Dr. Farrand brought out—that the physician does not always make the best health officer. Many people throughout the State of New York, legislators, county supervisors, and mayors of cities, think that the physician of good standing is thoroughly qualified to be a competent health officer. One further point is the relation of the physician to the whole public health problem. We hear every now and then of the reporting of communicable diseases being entirely unnecessary unless it is of advantage to the patient. Now the primary object of public health is not to cure the patient, but to prevent others from contracting the disease. One continually hears physicians say, "I do not see any sense in reporting contagious diseases unless it does my patient good."

Pres. LIVINGSTON FARRAND, M.D. (Boulder, Colorado): We have got to get away from the old point of view that health education, health administration, is an adjunct of the medical profession, and from the point of view that any sanitary engineer or other available person out of a job can step into the Health Administration Office and adequately administer it—in other words, we have got to prepare these men for a specialized profession. It is a profession which is calling for a high degree of technical training, and as such, in my judgment, it must be made a part of the University curriculum. We have the old idea, developed at the Massachusetts Institute of Technology, where the biological chemist was pre-eminent and where the medical aspect was almost entirely overlooked. Coming up from this we might get a perfectly good health administrator, but he would have to acquire his medical point afterwards. Then there is the idea which, starting at Harvard and developed at one or two other places, insists on the medical aspect to the exclusion of the biological chemist and sanitary engineer. Of course, the recent merging of Harvard and the "Tech." may bring about the well-rounded project we are striving for. In a number of other places they are attempting the establishment of schools of medicine and public health which are placing the problem upon a professional basis—upon a graduate basis. That is, the doctor of public health will obtain the degree of D.P.H. He will be given a well planned course, and only well qualified persons will be admitted; and while the degree of M.D. is not required, we do insist that during the years he is working for his degree, whether it be the master's degree or the doctor's degree, he shall have a very complete training in the medical side of the problem, and in connection with this that he shall be thoroughly trained in the sanitary engineering, biological and sociological sides. In other words, we cannot see why a man who is to become a qualified health officer, a man qualified in preventive medicine and public health administration, should not be able to select

one of these general aspects and specialize in it, demanding at the same time that he shall have a general training in the other three. In the establishment of this school we are met again by a practical difficulty. Many of the health offices in small country places are administered by physicians, and by physicians who are not able to be in touch with all the developments of modern medicine. Those men have a right to training, and so we have come to develop a sort of correspondence course for health officers, including a regular graduate course, for men such as these, who are operating health offices in small country towns. These men will do a certain amount of work through correspondence, and will then go to the summer school of the University for a period of six weeks for several successive summers, at the end of which time they will get a certificate for work accomplished and will have made themselves relatively competent medical health officers. I believe that until we can produce at the various centres of education—and those centres must be medical depôts, or they cannot furnish the trained health officer—until we can produce enough men to fill the positions, which the enactments of the legislature is beginning to multiply, we have got to make a practical utilization of some such method as I have outlined. I think it is an excellent thing that the half-dozen Universities that are developing this specialized educational plan are not following along the same lines. We have come to no agreement as to what a standard curriculum in this field should be, and I think it is entirely wise that Harvard and the "Tech." should try out one form, that Minnesota should develop another, that we in Colorado should try out another, and California still a fourth. In the course of a few years experience will show what we need. In the meantime I think the sane view is to repudiate the idea that it is only the doctor of medicine who can be a qualified health officer. Personally I should say that ten years' practice would go far to disqualify a man. I think we must be careful to insist that the man who is to occupy this position shall not be simply a biologist or a sanitary engineer, but a man trained, and thoroughly trained, in the medical aspects of the problem. Ignorance on the latter side is just as grave a danger in the field of public health as an overemphasis of the medical aspect to the neglect of these other features.

HEREDITARY HÆMORRHAGIC TELANGIECTASIA, WITH REPORT OF THREE FAMILIES AND A REVIEW OF THOSE PREVIOUSLY RECORDED.

By WALTER R. STEINER, M.D.

In 1865 Babbington [1] reported an interesting family, in whom recurring epistaxis had been observed for five generations. The transmission was through both male and female, but no mention was made of telangiectases in any of them. The first family in whom these telangiectases were found was reported eleven years later by Legg [2], who described numerous small nævi on the face, forehead, and trunk of his patient. They had developed about his 41st year. These cases were followed by others reported by Chiari [3], Rendu [4], Osler [5], Josserand [6], Kelly [7], Hawthorne [8], Parkes Weber [9], Phillips [10], Waggett [11], and Ballantyne [12]. Rendu, however, was the first of these observers to associate the presence of epistaxis, with multiple telangiectases, as clinical manifestations of a distinct morbid entity. Henceforth the erroneous diagnoses of hemophilia, acquired angeiomata from cirrhosis of the liver, and hæmorrhagic diathesis were no longer applied to this condition. Further interest in its study was aroused by the papers of Sir William Osler, whose first published article upon it

appeared in 1901. Most of these cases were carefully abstracted, in 1909, by Hanes [13] when he reviewed the literature upon this subject, and carefully described two additional families, so that fifteen were then reported [14]. Since then eleven more families have been described, including the three here detailed, so that this condition has now been found to exist in twenty-eight families [15]. Other isolated instances, with no further cases in any of their families, have been reported by Chauffard [16], Kelly [17], Fox [18], Galloway [19], Lack [20], and Adamson [21], but I have omitted all consideration of them on account of their lack of any hereditary tendency towards this condition.

It has been defined as an hereditary affection manifesting itself in localized dilatations of capillaries and venules, forming distinct groups or telangiectases, which occur especially upon the skin of the face, nasal and buccal mucous membranes, and give rise to profuse hæmorrhage, either spontaneously or as the result of trauma (Hanes).

In its causation an hereditary tendency is the only factor which is constantly present, although others, such as syphilis, alcohol, and traumatisms, have been irregularly reported. A history of syphilis, however, is only recorded in three instances, yet its unrecognized presence may probably have existed in a somewhat greater frequency. Stokes [22] recently has written an interesting article, showing that syphilis, chronic plumbism, hyperthyroidism, and nephritis may cause cardio-vascular degenerative conditions, which result in the formation of generalized telangiectasia. Alcohol, likewise, is a most inconstant factor, which is only thrice stated to have been present, and traumatism of etiological importance is just as rarely seen, for it appears but twice in the histories of the twenty-eight families exhibiting this

condition, although it must be stated, as Hanes has previously shown, that the telangiectases are generally located at points most subject to frequent, slight traumatisms. The bleeding in these cases is often so severe that a condition of marked anæmia is induced, which may be an important factor in the development of the telangiectases. Certain it is that the bleeding generally precedes the formation of these localized dilatations of the capillaries and venules, and may do so with many years intervening between them. In some of the cases, also, a respite from the bleeding appears to be coincident with the disappearance of the telangiectases. Cases have been reported in England, France, Germany, Denmark, and the United States. The Anglo-Germanic race has furnished most of the examples, followed by the Latin and Scandinavian.

Kelly thinks October to May are the months in which the bleeding is most apt to occur, but other observers have not corroborated this fact. Hutchison and Oliver thought their patient bled more during the summer months. It has been noted in 85 males and 77 females, so its distribution among the sexes is probably about equal. Both sexes are able to transmit it. In the published cases 32 females have transmitted the tendency, as against 39 males. The pathology of this condition has been investigated on three occasions. First, when Dr. Mabel Austin examined, at Dr. Osler's suggestion, a section of the nasal mucous membrane of a patient in the first family which Dr. Osler reported. This patient was the first to come to autopsy, which revealed "cancer of the stomach, mesentery and omentum, liver, retroperitoneal glands, lungs, and brain." In the stomach there were also found "a dozen round foci, each 3 mm. to 4 mm. in size, which at first looked like ecchymoses, but were dilated venules and capillaries." The sections of the

septum of the nose showed large dilated veins just beneath the epithelium. Our information from the second case comes from a biopsy which Dr. Hanes performed on one of his patients. The tissue was removed from a telangiectatic spot and showed "the obliteration of the papillæ of the corium, together with the absence of the usual undulations of the stratum germinativum. This is doubtless due to the relatively enormous dilatation of the blood-vessels of the corium, which are seen as wide spaces lined by a single layer of endothelium lying immediately subjacent to the greatly attenuated epidermis. These dilated vessels can be traced well down into the subcutaneous fatty tissue. A study of sections stained by various special methods failed to reveal any muscular or elastic tissue in the walls of the dilated superficial vessels, although the less dilated vessels in the subcutaneous fatty tissue show the normal arrangement of the tunicæ." Consequently, Hanes refers to the insufficient protection of the dilated vessels, and states that it is not surprising that trivial traumatisms produce marked hæmorrhage.

In one of the family reported by Gjessing a microscopical examination was made from an angioma on the left cheek. In the corium blood-filled cavities were found, surrounded by a single layer of endothelium and a thin stratum of connective tissue, devoid of elastic or smooth muscle fibres. In some places the cavities extended upwards to the epidermis, where the papillæ were flattened. In one spot the cavity extended down into the subcutaneous tissue, where, in the surrounding area, numerous well developed hair follicles and sebaceous glands were seen. In this situation the elastic fibres were as numerous and well developed as in normal tissue. The changes then consist in a dilatation of the capillaries of the small veins, with the

formation of telangiectases of the three types which I shall later describe. These dilated vessels being only lined by endothelium, without the additional presence of elastic or muscle fibres, become consequently very liable to rupture, induced either spontaneously or by trauma.

The chief symptom is hæmorrhage, which may come from the telangiectases in the nose as an epistaxis or from those situated elsewhere. These locations are the conjunctivæ of the upper and lower lids, the ears, cheeks, nose, lips, mucous membrane of the mouth in the region of the hard or soft palate, the uvula, buccal mucous membranes or gums, tongue, neck, trunk, back, arms, finger-tips, under nails, or feet. The bleeding varies greatly in frequency. It may occur three to four times daily, once or twice a week, or even with a greater interval of freedom. Kelly has described a patient in whom it was most apt to take place between the months of October to March, when it would be both profuse and frequent. The amount of blood lost also varies greatly. In Kelly's patient, just referred to, it was so marked that death from syncope finally resulted. Legg and Chiari have reported cases in whom dropsy, ensuing from loss of blood, caused a fatal termination, while Phillips has recorded a case where death came from hæmorrhage of the gums. Chiari also mentions a child, in one of his families, as dying from a severe nose-bleed, and Gottheil speaks of a male dying from the same cause.

The bleeding may be a slight trickle from the nose or the spots, or come with more force. One of Hanes's patients found it not uncommon for him to injure one of the lingual telangiectases while eating, so that the blood would actually spurt from the injured spot and render further progress with the meal impossible. Gottheil has described two varieties of bleeding in one of his cases. From the nose it occurred as

a slow trickling, lasting perhaps ten or fifteen minutes, while from the visible lesions of the tongue and lips it came as a sudden projectile spurt, sometimes reaching out a foot or two, if on the lips, or if his mouth was open, and stopping spontaneously in two or three minutes. Langmead speaks of his patient as suffering for about twenty years from frequent epistaxis, and adds that occasionally his face or tongue has burst out bleeding. Legg also speaks of the bleeding from the spots as being frequently spontaneous in origin in his case, but generally, in all the instances, it is the result of traumatism, while the hæmorrhage from the nose is spontaneous in its onset.

Less severe bleeding has produced, by the resulting anæmia, vertigo, headaches, weakness, dyspnœa on exertion, palpitation, and swelling of the ankles. In one instance fainting was induced after a prolonged epistaxis, while another patient, depleted from the hæmorrhages, finally came down with an endocarditis. The prostration from this cause prevented another from working for about three years. The onset of the epistaxis is generally in early childhood, but the attacks become more severe and prolonged as the patients advance in years, the period between the 35th to 38th years being the time when the increase is especially noted. The telangiectases seen in this condition are of three varieties: the pin-point, which are most apt to be seen on the skin of the hands and face, and which may be readily overlooked; the spider form, which is the most common, and which Parkes Weber prefers to call spider angeiomata rather than spider nævi; and the nodular type, which may originate in the centre of a spider angeiomata, and finally form a solid vascular tumour, split pea in size. They are most frequently seen on the nasal and buccal mucous membranes and on the muco-cutaneous junction of the lips, but may be found in

the other locations mentioned above. They begin as capillary dilatations, and are bright red in colour. Later the venules give the cutaneous telangiectases a violaceous or purple colour by participating in their formation. The spots on the mucous membranes, however, always remain a bright red. They may be seen early in life, for Hanes has observed them in a boy of 8 years, but generally, if present, at such an age they are not especially numerous, for they do not attain their full number until after the age of 35. Even then they appear and disappear with marked frequency, and seem to bear some relation to the bleeding, being less marked if a considerable respite from hæmorrhages is observed. Parkes Weber speaks of a vicious cycle being established by the repeated attacks of bleeding giving rise to a grave condition of anæmia, which in its turn increases the tendency to hæmorrhage.

In Parkes Weber's case a small patch of chorio-retinitis was found in an examination of the fundus of the right eye by the ophthalmoscope, while in Sequeira's case the retinal vessels were thickened, but there were no hæmorrhages.

Before Rendu's time the disease was generally considered hemophilia. Chiari, however, caught a glimmer of the real truth when he first diagnosed the condition as one of telangiectases of the mucous membranes, which were hereditary in a family. Unfortunately, after a further study of his cases, he regarded the affection as due to hemophilia. The epistaxis or the telangiectases may exist alone in certain members of the family implicated, but the hereditary tendency in them, and the finding of the cardinal symptoms combined in other members of the family, will make the diagnosis simple. The fact that the females are not affected by hemophilia may be, at times, of diagnostic value.

The outlook is generally not very promising, for the

hæmorrhages are apt to increase in severity as middle life is reached, when the telangiectases are frequently first seen. In one of the cases, however, there was a cessation of the bleeding as this period was approached, while another only bled after this time from her nose and the telangiectases elsewhere at each menstrual period. In four out of the 139 cases death has been directly attributed to the hæmorrhages, in others it has involved much invalidism, while a third and smaller group has not been much incapacitated by them.

Rendu used with excellent result in his case an application of a powder upon the nasal mucous membranes of antipyrin, tannin, and powdered sugar, and Coe has reported upon the beneficial employment of calcium lactate and iron in his case, which he published as one of hemophilia. It is hard, however, to see the *rationale* of this treatment, for the disease is due to a developmental defect in the blood-vessels and measures to increase the coagulability of the blood ought not to yield good results. The use of iron and the application of the thermo-cautery to many of the spots might more reasonably explain the patients' improvement. A bead of chronic acid fused upon a probe was used with excellent success by Hanes, who recommends the method highly, as the action of the caustic may be checked at any time by the application of an alkali. The repeated use of this method may be necessary to check the bleeding. After the cause is thus removed, the use of iron and arsenic for the treatment of anæmia indicated. Although it has been unsuccessful in some cases, the cauterization of the troublesome bleeding areas appears to be the most satisfactory form of treatment. The use of radium for the nodular telangiectases might also be of avail.

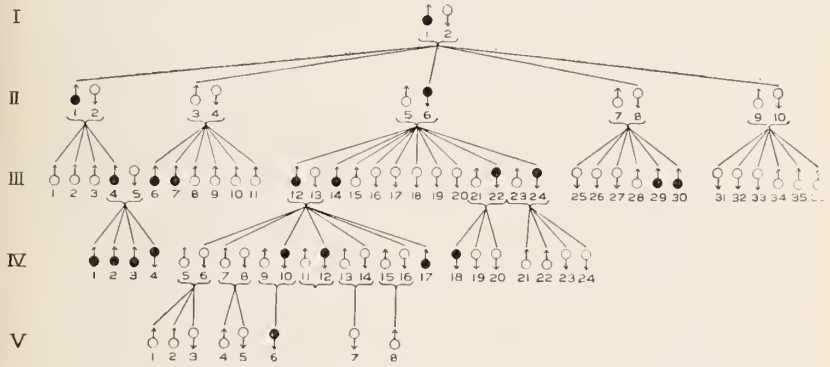
Since my interest was aroused in this condition from a case on the services of Sir William Osler, at the Johns

Hopkins Hospital, in 1899, I have seen instances of it in three families, and can give the following partial rehearsal of their histories:—

Family XXVI (Steiner, 1916). *Recurring hæmorrhages in five generations and twenty-one members of one family; telangiectases observed in five of them.*

F. G., aged 42 (Hospital No. 66559), was admitted to the Hartford Hospital February 23, 1913, complaining of weakness, shortness of breath, and frequent nose bleeds (III, 4).

Family History.—The patient's grandmother (I, 1) was a



Family XXVI, Steiner 1.

bleeder, as well as his father (II, 1) and one aunt (II, 6), all of whom are now dead. Of the aunt's family of ten children, two sons (III, 12 and III, 14) and two daughters (III, 22 and III, 24) are bleeders. One of the daughters (III, 22) has a girl (IV, 18) who is also a bleeder, and one son (III, 12) has two daughters (IV, 10 and IV, 12) and a son (IV, 17) who bleed likewise. One of these daughters, both of whom are married, has a daughter (V, 6) who bleeds from the nose. The histories of III, 22 and IV, 12 will be given later. Another aunt (II, 8) has two sons (III, 29 and III, 30) who are subject to epistaxis, and an uncle (II, 3) has likewise two sons (III, 6 and III, 7) who suffer from the same difficulty. The patient (III, 4) has three sons and a daughter (IV, 1; IV, 2; IV, 3; and IV, 4) who are similarly affected.

Present Illness.—The patient was in excellent health until he was 14 years old, when he began to suffer from frequent attacks of epistaxis, which were exceedingly difficult to control. They recurred weekly or at more frequent intervals. When he was 16 years old he had a slight hæmorrhage from a small red spot on his face, which was readily checked. Three years later he entered the Prussian Army and suffered from the above symptoms frequently, although the amount of blood lost was never very great. There was never any additional hæmorrhage noted from his mouth or rectum, and his urine never contained blood. He remained in a stationary condition during the four years he served in the Army, and in this period was observed by Army physicians and others, who told him the bleeding could not be checked. At the expiration of his Army service he emigrated to the United States, where he was frequently in very straitened circumstances. Occasionally he found employment in the Hartford coal yards. After two years he returned to Germany again, where he laboured successfully for thirteen years as a grocer and lumberman; then, meeting reverses, he came to this country again four years ago, and has since worked as a pedlar. During all this time he has had frequent attacks of epistaxis and has gradually grown weaker. For the past year dyspnœa on exertion as well as palpitation have been troublesome symptoms. The hæmorhages generally occur in the mornings and of late have been observed daily. His appetite has been good. There have been no digestive disturbances. His bowels have been constipated, but have recently been moved daily by medication. Of late years he has suffered from hæmorrhoids, which occasionally bleed somewhat. He had measles as a child. Denies venereal disease. Moderate smoker and drinker.

Physical Examination.—The patient was a well-nourished, well-developed Hebrew. The lungs were negative on examination, but the heart, which was not enlarged, revealed a soft systolic murmur at the apex, which was not transmitted outwards, but was heard with increasing intensity on passing upwards, being loudest at the base, in the pulmonic area, where the second sound was slightly accentuated. Over both cheeks, on either side of the nose, numerous angeiomata are seen, varying in size from pin-point to one 20 mm. below a mid-line drawn perpendicularly from the left lower eyelid,

which measures 3 mm. by 4 mm. in size. Two pin-head angeiomata are also seen on the nose, and on the mucous membrane of the lower lip ten more are noted, from pin-point to pin-head in size. On the tip of the tongue two are also observed, the larger measuring 2 mm. by 2 mm., while the smaller resembles a pin-head. Back of the wisdom tooth, on the right lower jaw, there is also one of a similar size, as well as on the buccal mucous membranes and on the posterior aspect of the tongue. Two small ones are likewise seen on the anterior aspect of the helix of the right ear, while six more are visible on the posterior surface. On the septum of the nose, as well as on the left inferior turbinate, similar angeiomata are observed, and some of them appear to have bled very recently. The mucous membranes of the nose as well as the conjunctivæ are very pale in colour.

Blood Examination.—Red blood corpuscles, 4,696,000; leucocytes, 4,800; hæmoglobin (Dare), 60 per cent.; coagulation time, three and a half minutes (Biffi-Brook's instrument). Differential count of 300 leucocytes.

Polymorphonuclears	61·00 per cent.
Lymphocytes	26·00 ,, ,,
Large mononuclears and transitionals	12·00 ,, ,,
Eosinophiles	1·00 ,, ,,

No myeloblasts; no normoblasts or megaloblasts; no poikilocytosis; slight anisocytosis. The urine examination was negative. On March 5 Dr. E. Terry Smith examined his nose, and observed the presence of an old atrophic rhinitis. He also noted some telangiectases on the septum and left inferior turbinate, which he cauterized on two separate occasions. His other treatment consisted in the use of rest, iron, and arsenic. Three days before discharge his hæmoglobin was 70 per cent., but the blood examination otherwise showed no change. On April 19 he was seen with me by Sir William Osler, who confirmed the diagnosis. He was discharged from the hospital March 23.

The patient was then lost track of by me and could not be traced, as he had moved from the residence he gave, until April 1, 1916, when he walked into my office. Since leaving the hospital he had worked steadily as a pedlar until recently,

when the hæmorrhages from the telangiectases on his face, tongue, and nose prostrated him so severely that he found himself in a very much weakened condition and unable to work. A few days later I had a Wassermann and Luetin test performed upon him, with negative results in both instances. The internal administration of the chloride of iron has yielded him some improvement.

Mrs. A. T., aged 33 (III, 22), was first seen by me at my office on March 20, 1909, complaining of bleeding from the face.

Family History is given in the recital of the history of the previous case.

Past History.—Typhoid fever when 24 years old of nine weeks duration, with complete recovery. Two years previously injured her thigh severely in an explosion. Her menses have been regular, occurring every twenty-eight days, with a duration varying from three to seven days, with slight pain. She has been married for ten years. Has had three children, the age of the eldest being 8 and of the youngest 3. The labours have been instrumental and difficult.

Present Illness.—She has bled from the nose ever since she can remember. The epistaxis begins and stops spontaneously. The intervals between the bleedings have varied from three to four weeks up to two or three months. One year ago ergot internally seemed to check them. At this time she first began to bleed from the tongue, pharynx, and hard palate. These hæmorrhages are also well controlled by ergot and the local application of tincture of ferric chloride. Ten days ago the bleeding began to be more profuse, and would come on, especially during eating, when mastication would frequently remove a clot from the tongue.

Physical Examination.—The patient was a well-nourished, well-built woman. The lips and mucous membranes were quite pale in colour. The tongue was clean. On the dorsum of the tongue, near its middle aspect and slightly to the right, was a raised nodular angeiomata, split pea in size, with a flattened summit, from the centre of which the pin-point opening of a blood-vessel was seen. The mucous membranes of the hard palate showed a number of telangiectases, pin-

head in size. They were also seen about the vicinity of the cheek bones, one on the left side of the nose to the right of the bridge and 1½ cm. from the tip, being of the nodular type and split pea in size. The others vary from pin-point to pin-head in size. All were bright red in colour and did not blanch on pressure. On the right hand, near the styloid process, was seen a spot pin-head in size. The heart revealed a soft systolic murmur at the apex, which is not transmitted outwards, and was heard with increasing intensity on passing upwards, being loudest at the pulmonic area. There was a soft systolic murmur in the vessels of the neck.

Blood Examination.—Red blood corpuscles, 4,304,000; leucocytes, 7,750; hæmoglobin (Dare), 55 per cent.; blood platelets (Pratt's method), 204,788; coagulation time (Biffi-Brook's method), two minutes. Differential count of 500 leucocytes.

Polymorphonuclears	61·80 per cent.
Lymphocytes...	26·00 ,, ,,
Large mononuclears and transitionals	9·00 ,, ,,
Eosinophiles...	2·00 ,, ,,
Mast cells	0·40 ,, ,,

No myeloblasts; no normoblasts or megaloblasts; no poikilocytosis; slight anisocytosis.

Subsequently the bleeding has increased in severity and frequency, so that the patient has occasionally been much prostrated by the secondary anæmia thus induced. The use of rest, iron, and arsenic has been of little avail.

Mrs. D. E., aged 25 (III, 6), was first seen by me at my office on April 26, 1909, complaining of bleeding from the nose.

Family history is given in the recital of the history of the first case.

Past History.—Influenza every winter since she can remember. Brain fever when very young. Measles as a child. Her menses began at 14, and were regular every twenty-eight days until five or six years ago, when they come a few days more frequently. She has much pain during the first two days.

Present Illness.—Nine years ago she first began to bleed from the nose. The hæmorrhages have come on since five

to six times a day, sometimes once a week, or more rarely once a month; occasionally there is a two to three months' interval. A little worry or excitement will generally bring on an attack, which frequently lasts five or ten minutes. Has never used anything to check the hæmorrhages, save cold water. Last summer first began to bleed from the tongue, and has bled thus about five times in all.

Physical Examination.—The patient was a well-nourished, well-built woman. The lips and mucous membranes were of good colour. Over the cheeks, chin, mucous membranes of the lower lip, and the tongue are telangiectases varying in size from a pin-head to two on the tongue, which are split pea in size and slightly raised. Some are of the spider type. All are cherry red in colour. Heart negative on examination. A Wassermann reaction upon the blood and spinal fluid was later performed with negative results.

Blood Examination.—Red blood corpuscles, 4,000,000; white blood corpuscles, 10,000; hæmoglobin, 75 per cent. The urine examination was negative. Subsequently the bleeding, especially from the nose, has increased in severity. The cauterization of the bleeding areas has been of little avail.

Family XXVII (Steiner). *Recurring epistaxis in three members of a family for two generations; telangiectases with epistaxis present in the only member of family seen.*

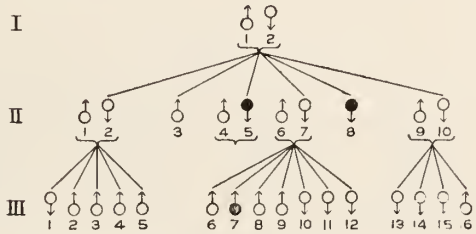
E. N., aged 41 (Hospital No. 66927) was admitted to the Hartford Hospital, on my medical service, March 17, 1913, complaining of being run down (II, 8).

Family History.—Her father had died of old age, her mother of pneumonia. Of her four sisters and one brother, one, a sister (II, 5), aged 47, had been subject to attacks of epistaxis all her life, but especially during childhood. She is married, but has no children. She resides in Stockholm, Sweden. Another sister (II, 7) has a son (III, 7), aged 17, who has had frequent attacks of epistaxis since early childhood. There are no others in the family subject to epistaxis.

Past History.—Measles at 8 years of age. Her menses began at 14, were regular every twenty-eight days, with a duration of six to seven days. The flow was always very profuse.

Present History.—When she was about 25 years old she began to have attacks of moderate epistaxis the day preceding the onset of each menstrual period. Her gums, however, have always bled easily when she cleans her teeth. Twelve years ago she emigrated to this country from Sweden, and two or three years later she began to have red spots on her cheeks. Two years later she noticed them upon her hands and wrists. Occasionally she has had slight attacks of dizziness during the past few months. For the past week has had one to three attacks of epistaxis daily, followed by sensations of weakness. The hæmorrhages last from ten to fifteen minutes and cease spontaneously.

Physical Examination.—The patient was a rather poorly nourished, slenderly built woman. The lips and mucous



Family XXVII, Steiner 2.

membranes were quite pale. Over the ears, cheeks, mucous membranes of the lips, tongue, and cheeks, wrists, hands, and feet were telangiectases, mostly of the nodular, pin-head-in-size type, but some were of the spider variety. Some are also seen under the nails of the middle and index fingers and thumb of the left hand. The lungs were negative. The heart was not enlarged, but revealed a presystolic thrill and murmur at the apex, sharply localized. A systolic murmur was also here audible which could be heard outward to the anterior axillary line and upwards to the base, but in both directions with decreasing intensity. The pulmonic second was accentuated.

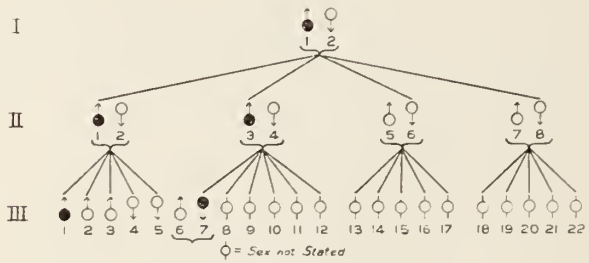
Blood Examination.—Red blood corpuscles, 2,560,000; white blood corpuscles, 5,200; hæmoglobin (Dare), 55 per cent.; coagulation time, four and a half minutes. Differential count:—

Polymorphonuclears	...	...	...	...	69·00	per cent.
Lymphocytes...	...	...	...	..	15·00	,, ,,
Large mononuclears and transitionals			...	...	24·00	,, ,,
Eosinophiles ...	...	...	...	...	2·00	,, ,,

No myeloblasts; one normoblast seen; marked anisocytosis; moderate poikilocytosis.

The patient refused to have the bleeding points in her nose cauterized. Her treatment consisted in the use of rest and iron. After a week's sojourn in the hospital, she left on March 24 to set sail for Sweden from New York on the following day.

Family XXVIII (Steiner III). *History of epistaxis and telangiectasis in a family for three generations.*



Family XXVIII, Steiner 3.

C. L., aged 62 (Hospital No. 86348) was admitted to the Hartford Hospital, on my medical service, March 15, 1916, complaining of a cough (II, 3).

Family History.—His father (I, 1), who died at 92, had telangiectases and nasal hæmorrhages, but further history about him was not obtainable. A brother (II, 3) had a similar condition as well as his brother's son (III, 1). Of the patient's six children, a daughter (III, 7) suffers from occasional attacks of epistaxis.

Past History.—Patient had always enjoyed good health. A few weeks before he entered the hospital he had a slight operation upon his tongue, for what he says was a cancer. He had bled from the nose occasionally since boyhood, but recently the attacks had lessened in severity and frequency.

Present Illness.—Four weeks ago he contracted a bronchitis, and has coughed considerably ever since. With the cough, he expectorates a little clear tenacious sputum. There are no other symptoms.

Physical Examination.—The patient was a well-developed, well-nourished Italian. There was evidence of a slight operation upon his tongue on the left side. The edges of the healed wound were not ulcerated, but felt indurated. The teeth were in a very bad condition, and the breath was very foul. The lungs revealed medium, moist râles at both bases posteriorly and in the left axilla. Over his forehead, cheeks, and nose pin-point, nodular, and spider angiomata were noted. The largest one of these was located on the left cheek, 4 cm. below a line drawn from the middle of the lower eyelid, and 1½ cm. from the left ala nasi. Under the use of expectorants his cough lessened in frequency, became looser in character, and finally left him. A Wassermann reaction was performed upon his blood, withdrawn from a vein at his left elbow, with negative results. His teeth were cleaned by Dr. W. N. Butler, one of our dental surgeons, and the patient was discharged from the hospital in good condition on April 12, 1916.

Conclusions.

From a consideration of these three families and those previously recorded, we may conclude that heredity is the only important etiological factor as yet discovered, and that both sexes are equally affected and equally capable of transmitting the disease. Microscopically, a developmental defect has been found in the dilated capillaries, as the elastic and muscle fibres appear to be wanting. The capillaries consequently are very liable to produce hæmorrhages by their rupture, which is either induced spontaneously or by traumatism. The hæmorrhages from the nose are generally seen early in life, while the telangiectases are a later development. The cautery in most instances offers the best results in the treatment of the bleeding telangiectases.

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[3] "Erfahrungen auf dem Gebiete der Hals und Nasenkrankheiten," Wien, 1887, pp. 60 and ff.

[4] *Gaz. des Hôpitaux,* 1896, vol. xlix, p. 1322.

[5] *Johns Hopkins Hosp. Bull.,* 1901, vol. xii, p. 333.

[6] *Bull. de la Soc. Méd. d. Hop. de Lyon,* 1902, vol. i, p. 244.

[7] *Glasgow Med. Journ.,* 1906, vol. lxv, p. 411.

[8] *Lancet,* 1906, vol. i, p. 90.

[9] *Lancet,* 1907, vol. ii, p. 160.

[10] *Proc. of Royal Soc. of Med.* (Laryn. Sect.), 1908, vol. i, p. 45.

[11] *Proc. of Royal Soc. of Med.* (Laryn. Sect.), 1908, vol. i, p. 70.

[12] *Glasgow Med. Journ.,* 1908, vol. lxx, p. 256.

[13] *Johns Hopkins Hosp. Bull.,* 1909, vol. xx, p. 63.

[14] In this enumeration the family reported by Josserand was unintentionally omitted, and Osler's second case seemed then to be an isolated instance, not of the family type. Later another member of the family, similarly affected, was discovered. Gottheil's family was also omitted from Hanes' list. It was published shortly before Hanes' article appeared. Hanes' list includes Babbington's family, in whom epistaxis was observed for five generations, but no mention is made of telangiectases in any of its members. It probably should be added to this group, but on account of the absence of positive evidence I have omitted it.

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[16] *Bull. et Mém. de la Soc. Méd. des Hop. de Paris,* 1896, vol. xiii, sér. 3, p. 352.

[17] *Proc. of Royal Soc. of Med.* (Laryn. Sect.), 1908, vol. i, p. 45.

[18] *Brit. Journ. Dermat.,* 1908, vol. xx, p. 145.

[19] *Proc. of Roy. Soc. of Med.* (Clin. Sect.), 1910-11, vol. iv, p. 42.

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THE DIAGNOSIS OF THORACIC ADENITIS.

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The importance of the diagnosis of enlargement of the bronchial glands lies in the fact of their intimate relationship anatomically with the lungs and air-passages. This relationship, therefore, naturally predisposes their involvement in many pulmonary infections. The term "thoracic glands" is better substituted for "bronchial glands," the one now in use, as it is made to cover those groups of lymph-nodes situated not only about the roots of the lungs, but also on either side of the trachea.

The tracheal group of glands, according to Sukiennikow, are located on either side of the trachea, laterally rather than antero-posteriorly, are more numerous on the right side towards the lower part of the trachea, and vary in number from ten to fifteen. The bronchial glands are most numerous beneath the right bronchus, but they are also situated on either side of the trachea at its bifurcation below it, and in close connection with the various divisions of both bronchi.

Blake, in his work on "Children," has shown that the bifurcation of the trachea is behind the right side of the sternum, at the level of the third costal cartilage, and posteriorly at the level of the intervertebral disc between the fourth and fifth thoracic vertebræ. From this point the left bronchus extends into the lung on a line drawn to the angle of the scapula, while the right extends much more directly

downward, almost equidistant between the vertebral spines and the angle of the scapula on the right side. The anatomical position, therefore, of the trachea and the bronchi with their clustering glands at once designates the regions in which physical signs and symptoms will be detected from their enlargement. Their close association, also, to the vagus nerve, phrenic nerves, and superior vena cava readily accounts for some of the signs which have been considered pathognomonic of their presence.

The group of signs associated with bronchial gland enlargement is largely limited to the interscapular region, as at this point they come nearest to the chest-wall. Quain, in discussing the lymphatic circulation in the chest, speaks of the intimate connection of the lymphatics of the visceral pleura and of those of the peritoneal cavity, and says that the bronchial glands drain the lymphatics from pleura and lungs.

The largest group of glands, in point of number, is situated in close relationship to the hilus of the bronchi, slightly more anteriorly than posteriorly, and occurring at about the level of the fifth dorsal vertebra. Normally there is great variation in size of these various groups of glands, the average being rather less than 1 c.c. in diameter. Engel, in a study of the anatomical relation of the thoracic glands by means of the X-ray, found the largest group in the cleft of the trachea. The change in the position of the gland and bronchial shadows with increasing years was noted; in the child they bordered on the heart-shadow, and with adult life tended to fuse with the central heart-shadow.

Pathology.

The immense amount of work done on the pathology of various lung conditions, especially tuberculosis in children

and young adults, makes it possible to determine the extent to, and frequency with, which the thoracic glands are affected. Their enlargement has been noted in many infections, not only in those of tuberculosis and in Hodgkin's disease, but also in acute contagious diseases of children, as measles and scarlet fever, pertussis, and, still more recently, in the common acute bronchial cold. In children the frequency with which tuberculosis shows itself in the bronchial glands has been noted by many observers. Harbitz found in 275 autopsies in children that 42 per cent. of these were positive for tuberculosis, and in a very considerable proportion of these positive cases the hilus glands were often the primary source of infection.

Wollstein, in infants, found the largest nodes among those glands on the right side in 74 per cent. of her autopsies.

Geill found the bronchial nodes involved 262 times in 902 autopsies, and of these, in 109 instances only were the bronchial nodes attacked. He also repeats the observation that of the lymph-nodes in the chest the hilus glands are most often attacked.

Boltz, in 101 fatal cases of pulmonary tuberculosis in children, reports that in only three were the bronchial glands not involved. Heinrich Schmidt, in 336 fatal cases of tuberculosis in children under 10 years, found that the disease was primary in the respiratory tract in 230, or 68·5 per cent.: in the lymph-nodes in 63, or 18·7 per cent., and where the lymph-node infection was primary, in one-half of these instances it occurred in the bronchial glands. Grawitz, Aufrecht, Berkman, and others called attention to the importance of the descent of tuberculosis from the cervical lymph-nodes through the lymphatics to the bronchial nodes and thence to the lungs.

Rachford believes that in tuberculosis the lymph-node is

by far the most important common form of initial infection in infancy and childhood, and that from this focus the disease spreads to other tissues. Pfeiffer believes, from clinical and anatomical observation, that tubercular infection, at least in childhood, takes place through the lymphatics, and especially through the tracheobronchial glands. One of the few dissenting opinions is that of Ghou, who believes that pulmonary tuberculosis is almost always primary in the lung substance, and that glandular infection invariably follows this where it occurs.

Symptoms.

The symptomatology of thoracic adenitis is still one of considerable uncertainty and obscurity. Most authors concur in the belief that infection of the lymphatic structures, whether in acute or chronic disease, may in itself give rise to definite symptoms. In many instances, however, after the initial period of infection has taken place, all symptoms may disappear. Lassitude, slight elevation of temperature, more or less constant thoracic pain, especially in the interscapular region, and a brassy cough are those most often noted. Our own observations have failed to detect any constant symptoms in this condition.

In extreme cases, where there is great enlargement or suppuration, signs of pressure with hoarseness, difficulty in breathing, and even stridor, have been reported. Hall cites an instance in which a caseous node ruptured into the bronchus and was expectorated. Griffin reports a case in which, as the result of enlarged and caseous nodes, fatal hæmorrhage occurred. Schmincke cites a case of rupture of a caseous bronchial gland into the left pulmonary vein with resulting miliary tuberculosis of the so-called Weigert form of miliary origin of tuberculosis. Caronia reports a case of

a seven-year-old boy on whom the rupture of a bronchial gland into the trachea was fatal through suffocation. Goodman cites several cases of fatal termination which were due to pressure of enlarged bronchial glands upon the pneumogastric nerve or due to occlusion of the trachea or bronchus.

While, however, the literature contains many striking instances of extreme signs and symptoms of thoracic gland infection, the ordinary symptoms are illusory and indefinite. Rachman speaks of anæmia, dyspnœa, lack of development, fever, night-sweats, lymphocytosis, and enlargement of external lymph-glands. No one or all of these symptoms together, however, necessarily point to thoracic adenitis, and in a number of instances which have come under our personal observation marked enlargement of cervical and axillary glands has failed to be coincident with enlargement of those about the trachea and bronchi. Where, however, there occur persistently elevated temperature and pulse, harsh, dry cough, anæmia, and lack of normal development, especially in childhood, without other explanatory conditions, the possibility of thoracic adenitis should be considered.

Diagnosis.

The diagnosis of this condition has given rise to a great variety of opinions as to the value of certain signs commonly associated with its presence. The more important ones are the enlargement of the superficial thoracic veins, the irregularity of the pupils, the so-called Eustace Smith sign, which may be described as a venous hum or bruit over the root of the neck on full extension of the head; an increase of the normal area of dulness, extending outward on either side of the sternum; d'Espine's sign, defined as a prolongation of the whispered voice below the first dorsal

vertebræ, called by some a postphonal sound; vertebral dulness, resistance, or both, below the first dorsal spine, which does not change with full inspiration. One or more of these signs, supplemented by positive evidence of a fluoroscopic examination and X-ray plate, are generally considered pathognomonic of tracheobronchial adenitis.

Our own observations have led us to believe that in children where the bronchial glands on the right side are considerably enlarged there not infrequently occur at the right apex definite signs of consolidation, such as dulness, increased resistance, limited expansion, and broncho-vesicular breathing. Prolonged observation, clinically and by means of the X-ray, have shown in these cases no apical lesion, and, with subsidence of the bronchial nodes and as the result of pulmonary gymnastics, entire disappearance of these signs. The explanation of this condition would seem to be due to a retraction of the apex, together with a reflex limitation of its function.

Grancher states his belief that the healthy child may show an exaggeration of the normal sounds at the right apex concomitant with bronchial adenitis. Hollepeter, in speaking of the early recognition of tuberculosis in childhood, lays stress on Smith's sign. This we have found, in our series of ninety-eight cases, occurred only twice, even where they were repeatedly observed over a period of time varying from one month to eight years. We therefore feel that this sign, at least, except in extreme cases where there is obstruction from pressure, is of little value.

Neumann has recognized in bronchial gland enlargement that there are signs at the apex, less frequently some enlargement of the thoracic veins, and seldom the presence of a systolic murmur at the root of the neck. The sign described by d'Espine in 1907 is the one most commonly associated

with the diagnosis of thoracic adenitis. At the present time there is, however, far from unanimity of opinion among clinicians as to its diagnostic value.

Riviere believes this sign to be secondary in value to percussion. Smith and Sweet believe that, except in rare instances, a positive d'Espine sign means enlarged bronchial glands, and in over 90 per cent. of their cases where it occurred the X-ray supported these findings. Stoll states that in four cases which had shown a marked d'Espine sign, at autopsy all had markedly enlarged bronchial glands.

Golz, speaking of the symptom-complex of tuberculous bronchial glands in childhood, states that d'Espine's sign is a new specific sign of bronchial gland enlargement, and considers that where it occurs below the seventh cervical vertebra it is pathological. He found that in sixty-six cases in children showing what was considered to be tubercular bronchial glands, the d'Espine sign was negative in five, doubtfully positive in fifteen, and marked in forty-six. In many instances the extent of the sign down the column was more marked than either vertebral or paravertebral dulness.

Speder and Dubourg consider the d'Espine sign as one of the most exact physical signs of bronchial adenopathy. D'Espine himself states that bronchophony is the earliest symptom of enlarged bronchial glands, and mentions a number of cases to prove that where they are found they coexist with, or precede, pulmonary tuberculosis.

Adolph d'Espine has noted the fact that d'Espine's sign, together with other signs associated with bronchial gland enlargement, persists or disappears according to whether the cases recover from the affection or not. He concludes that the tubercular nature of the condition can only be admitted if the auscultatory sign persists without change for five or six months at least. Our observations in regard to

d'Espine's sign, which is the one most depended upon by clinicians in this country to make the diagnosis of bronchial adenopathy, have led us to believe that it is of less value than most of the other signs obtained by auscultation and percussion. In many instances we have found that a well-marked d'Espine sign has been obtained which has persisted for a few weeks or months, where the X-ray has failed to corroborate the findings of enlarged bronchial glands. A number of cases which have been under observation for several years have lost this sign where it had previously been present, and it has not returned even with other evidence of enlarged bronchial glands. On the other hand, in about thirty cases it has first appeared and subsequently has been followed by other signs of gland enlargement, such as vertebral and paravertebral dulness, and positve X-ray findings. We have also noted its appearance well down the dorsal spine, limited to a single vertebra, being absent elsewhere.

In contrast, therefore, to the variation of the findings in regard to d'Espine's sign, we have noted the marked persistency of vertebral and paravertebral dulness over a period of several years where they have once been obtained. These latter signs, furthermore, much more commonly accompany vertebral bronchophony where the patient has had definite exposure to pulmonary tuberculosis.

Da Costa has found a distinct advantage in the use of spinal percussion, and he feels that a strip of vertebral dulness below the fourth thoracic spine is of great significance and very commonly corroborated by X-ray findings. Rachford believes that most physical signs are unreliable on account of their variability, and lays more stress on parasternal dulness than any of the others.

Neumann has recognized in one-sixth of his cases that

paravertebral dulness has much increased and is much more constant than other signs of bronchial glands. Krämer says bronchial gland dulness means more or less change in the sounds to the right or left near the vertebral column between the spine and the angle of the scapula. Turban has stated that, while swelling of these glands can frequently be discovered by percussion in the child's thorax, it is not so constant in adults. Bohland believes that parasternal dulness is much more constant in children than in adults. Blumenfield, Umber, and Dantwitz believe that positive percussion findings are almost always confirmed by the X-ray. Riviere speaks of the constancy with which the percussion note in the interscapular region is impaired in chronically enlarged glands. He says that this impairment is an early sign of tracheobronchial enlargement due to tuberculosis, and occurs on the right side only. He has noted the relative infrequency of left-sided impairment in the early stages. Where there is right-sided glandular disease the area of paravertebral dulness often extends outward two or three inches from the median line and as low as the eighth dorsal spine.

A summary of our own cases, corroborated by X-ray findings, shows that in only five of thirty-two instances where parasternal dulness was obtained was the X-ray negative; whereas in forty out of seventy-eight cases where d'Espine's sign was obtained, the X-ray was negative.

Considerable discussion has taken place in regard to the extent and size of bronchial gland enlargement that is necessary to enable them to be detected. Fetterholf and Giddings, after a study of frozen sections of a child's thorax, think it highly problematical that enlargement of the bronchial nodes can be accurately diagnosed by percussion, on account of their close relationship to the arch of the aorta, thymus, and other structures. Certain observers believe that

it is impossible to detect pathological changes unless the area involved is at least 5 c.c. in diameter and close to the surface.

In our work with children and young adults we have found that this statement must be considerably modified in the diagnosis of bronchial gland masses. In many instances, both clinically and by X-ray, hypertrophy of the bronchial glands has been shown where these areas were one-half or two-thirds this size.

No work in the diagnosis of obscure mediastinal conditions is complete without the use of the X-ray, and this is especially true in the study of thoracic adenitis. Most authors agree that the oblique use of the ray with full expansion of the chest is important to give the best results. The fluoroscope may be of value in detection of acutely enlarged glands which would not be brought out by the plate, except where this condition was of considerable duration or in which lime salts had been deposited. In many instances the heart-shadow on the left may obscure changes at the left hilus.

Engel says that it is difficult to ascertain enlarged and changed bronchial glands röntgenostically except where they are enlarged and lime salts have been deposited. If they are not thick and enlarged, to be recognized they must be homogeneous, corresponding in size and contour and conforming to the projection of the bronchial tree.

The calcified gland, according to De la Camp, shows a shadow with a thick central portion. Speder and Dubourg conclude that in all cases where there are distinct signs of tracheobronchial gland enlargement the X-ray invariably corroborates the diagnosis, and that in many instances where the interpretation is doubtful it will clear up the condition. Owen and Morton believe that pulmonary vessels contribute

little to the hilus shadow, and that in many instances extensive conditions will be found in this region by use of the X-ray which clinically are of slight extent.

From our work with a selected number of cases and with a period of observation extending over several years, we feel that Heubner's statement that the picture of the disease of the tracheobronchial glands is entirely a problematical sketch is a correct one. No single sign should be depended upon to make a diagnosis of this condition, but in the great majority of instances where vertebral, parasternal, or paravertebral dulness occurs the diagnosis is correct.

D'Espine's sign is of importance, but to a lesser degree, we believe, than was formerly thought. It may, however, be the first clinical sign to appear, and, we believe, may often be the only one which is present in acute respiratory infections.

Many of the other signs and symptoms described, such as enlarged thoracic veins, Smith's sign, irregular pupils, hoarse barking cough, and others, while they may occasionally occur in extreme cases of adenopathy, are too infrequently present to be relied upon. No study of the bronchi or hilus region of the lungs is complete without repeated X-ray examinations, but even here the conditions present may be confused on account of the other chest-shadows, and, therefore, reliance should not be placed upon it alone.

The work of Ghou, Rachford, Harbitz, Mueller, and others has shown the frequency with which the thoracic glands are involved in the earliest stages of pulmonary tuberculosis, especially the bronchial glands, and it is rapidly becoming recognized that in many acute infections the inflammation of these structures may account for the persistence of the acute condition. On this account we believe that far too little stress has been laid upon thoracic adeno-

pathy, and with the advent of more exact methods in the study of diseases of the chest the importance of this condition will be recognized.

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ABSCESS OF THE LUNG FOLLOWING OPERATION ON THE TONSILS AND UPPER AIR TRACT.

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In a paper read before the Medical Society of the District of Columbia, March 20, 1912, on "Tonsillectomy, with Consideration of its Complications," and in another paper read before the American Laryngological Association, May 11, 1912, on the same subject, I first called to my co-workers' attention this serious complication following the excision of the tonsils.

When one considers the nature of the wound left after a complete tonsillectomy—a deep cul-de-sac between the pillars of the fauces with more or less bruised tissue dependent upon the amount of sponging, clamping, and ligature of vessels, which is constantly bathed in a fluid rich in a varied flora—the wonder is not that serious infection takes place occasionally, but that such results are comparatively rare. That infections from this region, subsequent to operative intervention, have been so rare has been the wonder of my experience as an operator in laryngo-rhinology, especially, also, when one considers the anatomical relationship of the tonsils with its important venous and lymphatic supply. But while these remote lesions are rare, I am convinced that they are not so infrequent as one would judge

from reports hitherto made from the domain of laryngo-rhinology. In conversations with workers in this field, I have had narrated to me several cases that have occurred of septic infarct of the lung with resulting abscess which have never been reported, and wherein the condition was never recognized until the resulting pulmonary abscess had formed. Also, I have had an internist narrate a case which had come under his observation months after the patient had been discharged by the operating surgeon.

In preparing my original papers, I was surprised at finding the small number of cases of the various resulting complications of tonsillectomy reported by operators, and this, in my mind, is largely responsible for the paucity of reported cases of this type. The reason why this complication is not more frequently reported is probably twofold—viz., firstly, most operators, as workers in other fields of human endeavour, prefer to report their success, to minimize their untoward results, and forget them; secondly, the serious symptoms of pulmonary infection are not always immediate, are frequently indefinite and not recognized, and the patient is discharged by the operator with the tonsillar wound healed. When the pulmonary evidences become more pronounced the internist is called into attendance, and the operator probably never hears of the untoward pulmonary complications. While the laryngo-rhinologist has apparently failed to recognize in his publications the occurrence of pulmonary abscess following tonsillectomy and other intra-nasal operative surgery, we find from other sources—the internist and general surgeon—the recognition of pulmonary abscess as a complication of tonsillectomy and intra-nasal surgery, an awakening as to the importance of this complication, with the publication of the results of their observations. During the past three years we have had several excellent papers bearing upon this

most important theme by internists and general surgeons. The most important and interesting one is by Dr. Morris Manges, "The Occurrence of Abscess of the Lung after Tonsillectomy, with the Report of Nine Cases in Adults" [1]. One of the most interesting features of Dr. Manges' report is that "During the past six months six patients have been admitted to Mount Sinai Hospital for the treatment of pulmonary abscess that has followed tonsillectomy. Such a large series of cases in such a short period deserves some notice in these days, when every tonsil is under the suspicion of being a possible focal infection in so many diseases of obscure origin." And also the observation that three cases reported for treatment at Mount Sinai Hospital for abscess of the lung secondary to tonsillectomy within a given period of six days. These three patients had been operated on at the same institution within a period of five days. All these cases were operated upon by skilled operators. Dr. Manges leaves us to infer that all of his nine cases were operated upon without the walls of Mount Sinai Hospital. In another paper, "Pulmonary Suppuration, &c.," [2] the same author states: "Tonsillectomy is occasionally the cause of lung abscess." Dr. Charles L. Scudder, in an article entitled, "A Report of the Cases of Lung Abscess at the Massachusetts General Hospital Clinic," [3] states: "Attention is attracted to lung abscess following tonsillectomy. There have been several cases in my experience. There is one case in this series which followed operation upon the nasal septum."

If nine such serious complications of tonsillectomy came within the medical wards of a single hospital within a year, how many must be the aggregate coming within the wards of the many hospitals throughout the civilized world wherein tonsillectomy is performed?

The causation of pulmonary abscess secondary to tonsillectomy is in all probability through embolism or infection of the lung. At the time of the operation a large number of veins are opened, and these may remain patulous for several days. Septic clots or septic material may thus be carried into the lungs. The character of the onset would lead one to conclude from a clinical point of view that the septic infarct more readily explains the etiology. The view is also held that they are due to the inspiration of infected blood or pieces of tonsillar tissue. I do not give much credence to the latter, as the blood which may be aspirated is not infected, and in the modern operation for tonsillectomy there should be no pieces of tonsillar tissue to aspirate.

The onset of a pulmonary septic infection after a tonsillectomy or other naso-pharyngeal operative procedure is fairly characteristic, although frequently overlooked. The progress of the case for several days follows the usual post-operative course of such cases—indeed, may progress for a week or more, without marked untoward symptoms being manifest. The earliest symptoms are return of fever, septic in character, pain in the chest, and violent coughing. The physical signs at this period are very meagre, depending on the size and location of the area involved. The physical signs present at this stage may be dulness over the area affected, diminished breath sounds, and crepitant or sub-crepitant râles. With the development of the abscess we have characteristic symptoms manifested—viz., the expectoration of pus, pain, hæmoptysis, and foul odour. In the early stages the odour is only noted by the patient, who constantly refers to the foul, unpleasant odour at coughing, and the sickening sweetish taste of the expectorate. In the several cases which I have had under my observation the odour of the breath was never noticed as disagreeable, although the

expectorate from the same patient had a distinctly unpleasant odour. The cough persists, the fever becomes distinctly septic, the fingers club, and the patient gradually loses flesh. The physical signs at this stage are those of lung abscess.

On June 10, 1909, I operated upon a vigorous, rather large man of 45 years of age for the removal of both tonsils. The convalescence was slow. A moderate fever continued for six days. On the seventh day the patient returned to his home and was lost sight of by me for nearly ten days, although under the constant care of his family physician. When I saw him again in consultation I found the patient a very ill man. He was running a septic temperature, coughing constantly, complaining of great pain at the base of his right lung, and presented a very anxious and distressed countenance. A slight area of dulness, diminished breath sound, with some moist râles could be made out over the base of the right lung posteriorly. Before I saw him again he was taken to his home in a distant State. Several weeks later I heard from his wife that the evidences of pulmonary abscess had fully developed. He was operated on at the Mayo Clinic; the abscess was drained, with a complete recovery.

In December, 1911, I operated upon a young married woman, aged 24, for hypertrophied tonsils. The operation was simple in procedure, with very little hæmorrhage. The patient's throat was unusually sore for several days, and the convalescence was slow. Ten days after the operation she developed a severe cough, intense pain in the upper lobe of right lung, with a septic temperature curve. Physical signs were absolutely negative. On the thirteenth day the cough, paroxysmal in character, was more annoying. She now began to expectorate a large quantity of purulent, very offensive secretion, and complained greatly of an intensely

offensive odour whenever she coughed. Examination of the sputum, which was very offensive in odour, demonstrated it to be made up largely of pus cells. The infecting organism was found to be streptococcus. Physical signs demonstrated a small consolidation between the second and fourth rib on the right side with small mucous râles. On the fifteenth and sixteenth days she again had great pain in upper portion of right lung. This pain recurred again on the twentieth day of illness. The patient made a complete recovery in the course of four months.

While preparing this paper, the following case came under my observation :—

On March 22, 1916, I operated upon E. E. S., aged 26, for very large tonsils. The operation was without incident, excepting for the necessity of ligating a vessel on the left side and for a bleeding on the right side, which was apparently controlled without ligation. At 7.30 p.m. the same day I was notified that the patient was bleeding quite freely, and that a great swelling had formed in the right side of his throat. On arriving at the hospital I found that my patient was bleeding too freely from the right tonsil, and that the tumour referred to was a large blood-clot that had formed in the rather deep tonsillar fossa. As the patient could not control himself, and as the throat was very tender, I concluded that it would be useless to make any attempt to control the hæmorrhage excepting by placing the patient under a general anæsthetic. Ether was administered, the clots removed, and efforts were made to tie the vessel. This effort was futile, as all ligatures tore through the muscles, so I was obliged to pack the cavity and suture the pillars over the packing. The following day the pillars were released and the packing removed. On the second day the patient complained of some soreness in the middle lobe of the right lung. As the patient's temperature was normal, he was discharged from the hospital on March 25. From March 25 to March 30 there was no incident in the case, the patient reporting every alternate day at my office for local treatment. During this

period his temperature had shown no elevation. From the fact that throughout this period he had on several occasions spoken of the pain in the upper portion of right lung, I was led to anticipate the impending issue, although the freedom from fever, as late as March 30, the time of his previous visit and the existence of only a moderate cough, had given me a slight hope that I was being influenced by the thoughts of this paper. On April 3 he reported to my office, stating that he felt worse. The temperature was 101° F. He stated that since he had seen me the pain in the upper portion of his right lung had grown worse, he had had frequent paroxysms of coughing, with a copious expectoration, and a foul odour whenever he coughed. Examination of the chest showed a flatness over the right infra-clavicular region, and I then elicited the history that several years ago he had had a severe double pneumonia. A small area of dulness of fan-like formation, with the apex at about the third rib, and extending outward with the base towards the axilla, between the second and fifth ribs, was demonstrated. The breath sounds were broncho-vesicular over this area, and small râles were noted. The patient was ordered home to bed. From the description of his sensations there was no doubt that his temperature must have been quite elevated the evening of March 30, as well as on each subsequent day. His maximum rise of temperature April 4, 5 and 6 was 102·3° F. During the night of April 6 the patient was aroused by a violent paroxysm of coughing, which was attended with the expectoration of a large amount of foul pus and some blood. The copious expectoration was no doubt the evacuation of the abscess cavity. April 7: Patient appears entirely changed for the better; no fever; return of appetite; physical signs markedly improved; breathing faintly broncho-vesicular, with a peculiar rasp at termination of expiration. April 8: Improvement still continues; no fever; physical signs of lesion less clearly defined. April 9: Patient's condition still better. At office to permit of examination by Dr. Claytor. April 11: As no physical evidences of abnormal condition could be detected, as temperature had now been normal for five days, and as patient stated he felt perfectly well, he was discharged from further treatment. X-ray plate of chest was made April 8, 1916.

Two other cases with which I have been intimately associated, and which I had under my observation as consultant, will not be reported in this summary, as they form the subject of another paper to be read before you this day.

One of the objects in presenting this paper to you is for the purpose of again calling to the attention of the profession the fact that the performance of tonsillectomy is not the simple innocent surgical procedure that the laity and many of the internists seem to consider it; to again call to the attention of the profession that many immediate and some remote serious accidents or sequelæ may be brought about through the performance of this operation that may endanger the welfare and even the life of the patient. I do not question that these sequelæ and complications may at times be due to want of skill and technique, but firmly believe that more frequently they are beyond the control of the operator, and wholly independent of the case and attention paid to the post-operative management of the case.

When one considers the serious character of this form of complication, and the many others that may beset the path of the patient who is to undergo tonsillectomy, are we justified in considering it in so light a manner as we have in the past? Should we not weigh more carefully the evidence brought forward against the tonsil as the possible source of a remote infection, eliminating most thoroughly all the other possible sources of infection, before the tonsils are consigned to the surgeon for removal? The tonsils are so patent, they can be so easily examined and so readily condemned, according to the various standards that constitute a diseased tonsil, and thus apparently logically connected with the remote infection.

While at times the results attained are brilliant in the excision of the tonsils for remote infection, do we not also

find that many times the results are not compensatory for the risk through which the patient passes? We should always consider in cases wherein there is a reasonable doubt as to the tonsils being the organ at fault, whether the danger the patient is accepting through the tonsillectomy outweigh the importance and danger of the remote infection which it is sought to remove.

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LUNG ABSCESS FOLLOWING OPERATIONS UPON THE NOSE AND THROAT.

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This subject has been chosen because of the fact that of seven cases of lung abscess which have come under my personal observation in a comparatively short time no less than four have been directly traceable to an operation upon the nose or throat.

The infection in these cases reaches the lungs most probably in one of two ways, either as a septic embolus, which enters the circulation at the seat of the operation, or by direct inspiration of infected material during the period of anæsthesia; a third path of entry might be by the lymphatics. If pulmonary embolism were a common sequel of naso-pharyngeal surgery, one would expect instances of the violent symptoms characterizing the sudden blocking of a pulmonary vessel by an embolus, whether septic or not, which, as far as I know, are very unusual. While we must admit that the first method of infection is possible, the second seems the more likely, and, if this method of infection is accepted as the most usual, one is forced to the conclusion that there is something radically wrong, either in the technique of such operations or in the method of administering the anæsthetic,

I would make it very clear that I am not attempting any criticism of operations which, no doubt, are done in the way that skilful and careful laryngological surgeons have found to be the best, but feel that it would be no exaggeration to say that the average internist, and even the general surgeon, must have often stood aghast at the manner in which the tonsils are gouged out and the adenoids wrenched away with but little attempt to check hæmorrhage, while the unfortunate patient bubbles and gurgles, drawing into his lungs a mixture of blood, mucus, and perhaps a few small detached portions from more or less infected tonsils. After watching such an operation one wonders at the remarkable resistive powers that the human lungs show to infection. Why they do not all develop inspiration, pneumonia, or lung abscess seems the marvel. The fact that comparatively so few do suffer ill-effects is, in my mind, the strongest argument against the inspiratory mode of infection.

When we come to consider the method of administering the anæsthetic, however, there seems to be greater ground for criticism. Why would it not be better to give the ether by direct intratracheal insufflation? I am told that as the mixture of air and ether goes into the trachea in a steady stream under a constant pressure the exhaled air escapes around the inhalation tube, and that inspiration of foreign materials is impossible. If this is true, there seems no excuse for any other method of anæsthetization in this class of cases. I make no pretence as to knowledge upon the subject of anæsthesia, but simply would throw out this as a suggestion to those who are particularly interested in the subject.

I wish here to report four cases of lung abscess which, I think, have been clearly traced to operations upon the nose or throat under ether given in the usual way.

Case 1.—J. N., white, male, aged 41, labourer, was admitted to the Providence Hospital, April 30, 1913, for an operation upon a deflected nasal septum. One sister had died at 45 from spinal meningitis; the family history was otherwise good. The personal history was negative except for the nasal condition, for operation upon which he had entered the hospital. He had had a cough with slight expectoration of white, glairy mucus for several weeks before his admission.

He was operated upon on May 15. The temperature had been normal before operation. The next day it reached 103·4° F. The highest temperature on the 18th was 101° F., and it was recorded that he coughed very hard at intervals. On the 19th the temperature reached 101° F., and he complained of severe pain in right side. May 20, severe pain in side, expectoration blood-streaked, highest temperature 102° F. May 23, temperature 104·2° F., pulse 104, respiration 18. May 24, pain around heart, coughing a great deal. May 25, severe coughing, spells with severe pain in cardiac region, dyspnœa, and temperature 102·2° F. About June 1 the temperature began to show a hectic type, ranging from normal to 102° or 103° F. and above. The pulse ranged from 90 to 130, but the respirations seldom reached as high as 30 per minute. About June 12 the respirations ranged higher—30 to 36.

The patient came under my care on July 1, and the following condition was noted: Much emaciated, had lost 35 lb. to 40 lb., coughed frequently, and at times had severe paroxysms, at which times he expectorated quite large amounts of evil-smelling purulent sputum, the taste of which he likened to white lead. The temperature was hectic, the pulse and respirations rapid. Repeated examinations of the sputum had been negative for tubercle bacilli. On June 10 the leucocyte count was 25,000. On July 3 it was 11,000.

Physical Examination.—The antero-posterior diameter of chest was shallow, the left side lagged, there was a marked depression below the left clavicle, the apex beat was in normal position, fremitus more marked over right side of chest, dulness over upper left lung running down from the clavicle into cardiac dulness, right side negative, heart dulness normal to the right and below. On auscultation the

most marked feature was an area of pecteriloquy just above the left nipple, becoming less marked in an outward direction. The cracked pot sound could be elicited over this area at times. The signs suggested the presence of a small cavity, which at times was filled with pus and at others was rather empty. There were râles over the dull area above.

On July 8 the chest was opened by Dr. Edward M. Parker over the spot where a cavity was suspected to exist. The pleural layers were found adherent; a small abscess was found and drained.

The temperature fell at once; prompt recovery followed, and the patient was discharged cured August 15.

In this instance I was able by the physical signs alone to locate exactly the spot at which to open the chest without the aid of the X-ray.

Case 2.—B. M., coloured, female, aged 27, was admitted to the Providence Hospital July 29, 1915, complaining of cough and pain in left shoulder. The family history was negative, except that her mother died of cancer of the stomach. Her personal history was negative, except for attacks of tonsillitis.

The present illness dated from June 30, 1915, when she had her tonsils removed. She left the hospital July 3, and soon noticed that the side of her face was swollen, and also that her cervical glands were enlarged. A cough developed and had continued ever since. The cough came on in paroxysms, and was accompanied by the expectoration of a considerable amount of very foul-smelling sputum, sometimes tinged with blood. The only relief from this troublesome cough was obtained by lying on her back. She had not lost any weight, but had had night sweats. The appetite was poor and the bowels constipated. The fever was hectic in type.

On September 22, when I made my first examination of the patient, the following condition was noted: Pleural friction over the left base posteriorly, extending from the angle of the scapula downward. About the region of the left scapula angle there was a small area which gave signs strongly suggestive of a cavity or consolidation about a large bronchus. The X-ray showed a shadow in this area about 2 in. in diameter. The rest of the lung picture was normal.

The temperature had run a distinctly septic type, ranging usually between 99° and 102° F.; the pulse range had been from 90 to 120; the respirations had not materially exceeded the normal.

The urine was normal, the sputum showed no tubercle bacilli, the leucocyte count on September 25 was 7,800. (The acute symptoms had then subsided and recovery had begun, so that this count was no indication of what it probably had been at the height of the disease.)

A diagnosis of pulmonary abscess was made, based upon the following symptoms and signs: Paroxysmal cough with expectoration of very fœtid sputum, at times streaked with blood; hectic temperature; signs of a small cavity; X-ray shadow indicating infiltration in the area of the above physical findings, the history of the conditions having immediately followed an operation for removal of the tonsils.

A surgeon was called in, and an operation decided upon. From this time, however, improvement began which went on to complete recovery. The patient was discharged as cured on October 16, three months and a half from the onset of symptoms.

Case 3.—J. S., white, male, aged 14. (Seen December 21, 1915, with Dr. Shoupe, through whose courtesy I make this report.)

Family history good. Personal history good.

Was operated upon for removal of tonsils and adenoids May 13, 1914. He returned to his home in three days, but did not feel well. In about ten days he was found to be running an irregular fever, which was pronounced malarial. He complained, however, of pain in the left side and remained in bed for a week. Afterwards he was taken away for his health, but on June 26 developed pneumonia. It was elicited, however, that there had been a continuous cough from the time of the operation. This cough gradually subsided. About January 15, 1915, the cough again developed and continued until March 4, when he went to bed with an attack which was diagnosed as grippe. A left-sided pleurisy developed, and a diagnosis of effusion was made. No test was made to determine the character of the fluid. Operation was declined, and he was taken to Asheville, where a diagnosis of tuberculosis was made, though no bacilli were found.

The sputum had become fœtid in March, 1915, but there was no large amount until August 8, when he spat up a great quantity of pus. He was taken to another specialist in tuberculosis in the fall of 1915, who also pronounced the disease tuberculous. Dr. Shoupe diagnosed lung abscess.

My examination on December 19, 1915, showed the following condition: Pale, thin, nails curved. (Leucocytes, 22,600.) No movement of left chest; the interspaces appeared to bulge slightly. Tactile fremitus was absent over entire left chest, except, perhaps, at extreme apex. Dulness merging into absolute flatness from above downward over entire left chest. The heart appeared to be pushed over toward the right, and there was impaired resonance over a triangular area at the right base close to the spine. The voice sounds were loud over the left apex, but growing fainter downward.

The sputum was almost pure pus, intensely fœtid, and had been at times quite bloody, there having been several hæmorrhages.

The radiograph taken by Dr. Groover showed an intense shadow over the entire left pulmonary area; no lung tissue could be made out at any point. The heart shadow was quite a little farther to the right than is normal. The right lung was in perfect condition, and Dr. Groover agreed with us that there was no evidence of tuberculosis.

The diagnosis was that of either a long neglected empyema, which had ruptured into the lung, or an enormous lung abscess which had destroyed almost all, if not the entire lung.

Dr. Jas. F. Mitchell, under local anæsthesia, opened and drained the pus cavity on December 22, 1915.

There was immediately a most marked change for the better. The harassing cough with the foul expectoration ceased, the colour and appetite improved, and the boy gained 5 lb. in one week. What the ultimate outcome in this case is to be no one can say. The improvement has been marvellous, but the left lung is gone, and there will almost of a certainty have to be some further surgical treatment to reduce the size of the left thoracic cavity. [NOTE, April 1, 1916.—To our great surprise the boy has apparently made a complete recovery. The wound has healed without further surgical interference.]

Case 4.—Mrs. J. P., aged 28, white.

This case I saw at the request of Dr. Jas. F. Mitchell, through whose courtesy I make the medical report.

The family history was good. The sufferer had had an attack which had been diagnosed as pneumonia nine or ten years before. Her best weight had been 135 lb. In the spring of 1915 she suffered from tinnitis, and, in order that the ear condition could be more satisfactorily treated, one of the turbinated bones was removed in May under general anæsthesia. (The surgeon told me that there was practically no bleeding from the operation.) In a few days she developed pain in the left side, which was diagnosed as pleurisy, and almost immediately a cough with fœtid expectoration began. The sputum soon became purulent, and a diagnosis of lung abscess was made. In October a consultant concluded that there was a tuberculous condition as well as an abscess, and suggested that the lung be collapsed.

The radiograph taken by Dr. J. H. Selby showed a shadow protruding beyond the heart shadow on the left of the space between the third and fifth ribs anteriorly, and the sixth and eighth ribs posteriorly.

As I only saw the patient in the operating room I had no opportunity to make a satisfactory physical examination, but I concluded that the abscess was not very near the surface and that there were no pleural adhesions. The incision in the back and resection of two ribs were done under local anæsthesia. No adhesions were found, so the lung pleura was stitched to the costal pleura around the edges of the incision, and the wound packed to favour adhesions. Three weeks later Dr. Mitchell opened and drained the abscess. The greatest relief has been experienced, the cough having practically ceased, together with the fœtid expectoration, and the patient states that she is able to taste and enjoy her food for the first time in months. There is every reason to expect a complete recovery.

Diagnosis.

The diagnosis in many cases of lung abscess is not difficult, especially when the cause is so evident as an operation upon the nose or throat. Here the symptoms usually

follow in such a clear sequence that one's suspicions are at once aroused.

The first positive evidence of a suppurative process after the development of irregular fever is usually the expectoration of fœtid sputum, which in the beginning may be scanty, becoming profuse as the cavity enlarges by a process of breaking down of the abscess walls. In other cases the fœtid sputum may be long in making its appearance, due to the fact that the abscess does not rupture for some time.

The amount of sputum varies, depending on the size of the abscess and the freedom with which the pus can gain access to the bronchial tree. In some cases the cavity seems at times to be closed for a while, only to reopen and cause a veritable deluge of pus, which may threaten the patient's life by suffocation. The sputum is always very purulent, and is said to show elastic tissue in almost every instance, though this has not been my experience, perhaps because of some improper laboratory technique by the clinical pathologist. The sputum is most offensive, the evil odour being quite as apparent to the sufferer as to the attendants, and is a serious obstacle to proper nourishment, as the appetite is often completely lost because of it. The sputum is yellowish to greenish, turning to brown or reddish, depending upon the admixture of blood resulting from the erosion of blood-vessels. Various organisms may be found, but knowledge of the variety is of no material aid in diagnosis and treatment.

There is, as a rule, a leucocytosis, which, of course, is of some value in making a differential diagnosis.

In such an article as this an elaborate discussion of the physical findings in abscess of the lung would not seem advisable. The signs are, of course, variable, depending on the stage of the process and upon its location. It is

sufficient to say that there is at first a consolidation, which is followed by cavity formation. The presence of a cavity can often be recognized, especially after free expectoration of pus, as was well exemplified by Case No. 1 of my series. A pleurisy develops if the inflammation surrounding the abscess reaches the surface, and a friction rub is then heard. There is not likely to be any displacement of organs unless, as in Case No. 3, the abscess reaches enormous proportions.

The great tendency is for these cases to be diagnosed as tuberculous, and thus is valuable time lost in the proper treatment. There is, usually, loss of flesh and strength, together with irregular fever and often sweats. For locating the position of the abscess the X-ray is a most valuable adjunct to the ordinary physical examination, and should always be sought. It is also of material aid in the diagnosis of the character of the lesion and in determining the condition of the other lung.

Prognosis.

The prognosis is always grave, though if the abscess can be satisfactorily drained early enough many of these cases recover. Those that are left to Nature usually die in the course of months or years from exhaustion or from some secondary septic process, such as a brain abscess. A few recover spontaneously.

Treatment.

While it is true that some of these abscesses do ultimately recover spontaneously, as did my second case, I am convinced from my own observation that the proper treatment consists in establishing free drainage as soon as the diagnosis is positively made. This should certainly be done after waiting a reasonable length of time for a spontaneous

recovery. It would seem best to operate under local anæsthesia, *first*, because it is far better that the patient remain in condition to cough and keep the bronchi free from pus, and thus prevent the likelihood of its inspiration into other areas; and, *second*, because the lung tissue itself is not sensitive, and, once the costal pleura has been passed through, the pain is insignificant. In many cases, especially those of moderately long standing, a pleurisy has been established which facilitates the ease of the operation, but in those cases where the inflammation about the abscess has not reached the surface a two-stage operation is best; that is, at the first operation the two layers of pleura should be encouraged to adhere, either by stitching them together or by packing, or by both. When adhesions are sufficiently strong the operation may be completed.

Another semi-surgical procedure would be the production of an artificial pneumothorax in the hope of forcing the pus out of its cavity and, by approximating the walls, encourage healing. I have had no experience, however, with this method of treatment.

I have made no mention of the various palliative measures, such as inhalations of creosote, &c. They may be tried if it seems desirable, or if for any reason an operation cannot be done. Open air and good food are necessary, as in any other suppurative condition.

Conclusions.

(1) There is too great a tendency to jump to the conclusion that loss of weight and strength, accompanied by a hectic fever and free expectoration over a number of weeks or months, is due to tuberculosis. Such cases should be subjected to a thorough physical examination and to radio-

graphy, and a leucocyte count as well as a sputum examination should be made.

(2) Because a lesion is located near the apex of the lung is no positive evidence that it is tuberculous.

(3) Delay before resorting to surgery may be fatal.

(4) The abscess may be long in manifesting itself after the primary infection has occurred.

(5) Abscess of the lung as a result of operations on the nose and throat is not so very uncommon.

(6) There is something wrong in the way these operations are done or in the way the anæsthetic is given, or in both.

(7) In view of the wholesale removal of tonsils, as now practised, there should be a more careful consideration of the possible dangers resulting from such operations, and greater precautions should be taken to guard against them.

Dr. HALL: In the diagnosis of thoracic adenitis there is one point which I think ought to be mentioned—that is, the shutting off of the air in the bronchus in pulmonary tuberculosis by the pressure of a single enlarged gland. It is only within a comparatively short time that this has been really recognized. Something like twenty years ago Osler stated that it was strange that it did not occur, or at least he had never seen it. I have made a diagnosis in two or three instances. In one the patient had a complete shutting off of the air current in one bronchus, and the respiratory sounds were so strikingly suppressed that one was reminded of a foreign body clogging the bronchus completely. We found a single large gland pressing upon the root of the bronchus, cutting it off completely. In one or two cases since I have seen the bronchus cut off so completely that I have had no doubt this must have been the mechanism, in the absence of aneurism and in the presence of very advanced tuberculosis. It is extremely interesting to study the effects of these large glands.

Dr. J. A. LICHTY (Pittsburg): I shall add just a word particularly because in the last month I have had just such a case as Dr. Hall describes in his discussion. The patient was admitted to the Mercy Hospital; aged about 40, who was very much emaciated. We thought he possibly had a malignant condition somewhere. His temperature was normal. His pulse was below 100. The physical examination was

negative. The urine was normal. He had a leucocytosis of 20,000, the polys being 87 per cent. On account of a rather vague history of irritability of the bladder and pain probably radiating from the left kidney an X-ray examination was made. This was negative. But shortly after the examination he had a frank hæmorrhage from the bladder which seemed, after cystoscopic examination and catheterization of the ureters, to come from the left kidney. No stone could be found, and the hæmorrhage from the kidney could not be interpreted. After this examination the patient felt so well, so much relieved, that he was allowed to go home at his request. He returned within a month having considerable dyspnœa and the signs of œdema of the lungs. At the base of the left lung there was considerable dulness and decreased vocal and tactile fremitus. The blood condition was the same as before. He died suddenly in three days with acute œdema of the lung. At autopsy a glandular enlargement was found which had pressed upon the bronchus of the left lower lobe and which seemed to have entirely obliterated the bronchus. There were multiple abscesses in the left lower lobe and a small empyema over the dome of the diaphragm on the left side containing about 300 c.c. of pus. The glandular enlargement was of the nature of a lymphadenoma. Metastatic anus were found in the lungs.

Dr. MINOR: I should like to say a word in regard to Dr. Floyd's paper to emphasize the fact that by no means always will the X-ray show enlarged glands. If these glands are caseous, and especially if they are calcified, they will show excellently; but it does not show simply enlarged glands. Also in my experience I have found that parasternal dulness is rare. The glands have to be very large and solid before you get dulness on the anterior chest wall; whereas paravertebral dulness is gotten in a good number of these cases.

Dr. BABCOCK: I should like to make a few remarks in regard to the subject of complications after tonsillectomies. I, like all of us, have had to advise these operations. I have had several dozen cases, from the ages of 6 to 68 years, and we have never yet had a bad hæmorrhage or pulmonary abscess. I believe firmly that the reason for this is that except in young children the tonsillectomy is always done under local anæsthesia. Although I am not willing to deny the possibility of septic embolism as the cause of pulmonary abscess, nevertheless I believe that abscesses are commonly due to aspiration of septic particles from the tonsil, and that it is in the cases in which ether anæsthesia is used that we are especially likely to get this complication. Secondly, in all the cases in which tonsillectomy is now done at my advice, a coagulation test of the blood is made, and if the blood does not coagulate within a reasonable length of time the patient is given calcium lactate, or coagulin is applied over the site of the operation immediately afterwards; and, as I say, we have not had a single hæmorrhage. Furthermore, I will not be responsible for a

tonsillectomy unless I know who is going to do it. It must be done by an operator who operates rapidly and skilfully, who does not lacerate the pillars or the throat, as I have seen done by several surgeons. Finally, with reference to the treatment of pulmonary abscess, I should like to say that I have seen brilliant results in the last year and a half from the use of autogenous vaccines. In one case, two years ago this summer, the lady had had a prolonged operation on the throat for the removal of tonsils and adenoids under ether anæsthesia. The ether was not carried to the point of complete anæsthesia, so that the patient coughed and undoubtedly aspirated particles into the lung. A gangrenous area developed, and the sputum on culture yielded the anaerobics fusiform bacillus. The vaccine arrested and cured the gangrene, and the lady made a complete recovery.

Dr. LICHTY: It occurred to me while I was listening to the papers on abscess of the lungs following tonsil operations that it would be well if the readers had differentiated between tonsillotomy, tonsillectomy, and enucleation of the tonsils. These are three different operations, and I believe that the results in each are different. I have had a number of patients operated upon. All three operations have been developed by the nose and throat men, and they now do an enucleation of the tonsils. In over 100 operations I have never had the complication of abscess of the lung, although in one case a patient came to me four weeks after a tonsillectomy with an abscess of the lung, making a favourable recovery after expectorating the abscess contents. In the operation of enucleation of the tonsils we have the nicest results if the patient is placed on the table with the head allowed to drop down over the edge, so that blood will flow toward the roof of the mouth and can be very easily sponged away; and if the vaporized anæsthetic ether is used there is very little trouble from hæmorrhage or shock.

Dr. JENNINGS: In recently running through the Press I came across five cases of pulmonary abscess which were reported in the *State Medical Journal*, two of them sequels of tonsillectomy. All of these patients were operated upon, and four of them recovered. Of the two cases following tonsillectomy, one developed the day following operation, the other ten days after operation. The first was unquestionably an inhalation pneumonia, and the second an embolic process. To my mind the question of abscess following tonsillectomy is one of technique, and I should like in this connection to speak of the Sluder operation. I have operated to a large extent in the past, but recently my operations have been done by laryngologists, and I have an opportunity to observe pretty thoroughly the technique of various men. Both of the two cases I have referred to were operated upon by one operator, and the traumatism was considerable in both. They were the slow, dig-out procedures. Now the Sluder operation is no more difficult; it takes the tonsils out just as quickly as the old tonsillitome

tonsillotomy, and the wound is left perfectly smooth. There is very rarely hæmorrhage. From my observations upon this point I think it is the operation that is to be recommended.

Dr. ROCHESTER: I shall speak on this subject very briefly. I feel that Dr. Claytor is right in his suggestion that these things are chiefly due to aspiration pneumonia and not to embolism. I have in mind in this connexion two or three cases which are of considerable interest. All of these cases were studied beforehand and carefully prepared for operation by local treatment of the tonsil. One other was not really a tonsillectomy. It was in the early days when we did tonsillotomies. I did it myself in my early enthusiasm for work of that kind. This case was a boy of 12, with very large tonsils, on whom I did a tonsillotomy without very careful study beforehand. About two weeks after the operation he developed a very acute tubercular pneumonia, followed by death. Undoubtedly his tonsils were tuberculous, but they were not investigated beforehand. Since then tonsillotomies have not been done in my practice. These patients have been referred to others for tonsillectomy. We have been very wisely told by Dr. Babcock that one ought always to select the operator. There are only three surgeons in Buffalo whom I would care to have operate on cases of that kind. I have had two cases within the last six months of bronchopneumonia which developed after a tonsillectomy, but which did not go on to abscess formation; and one case of true pulmonary abscess after a tonsillectomy done by a general surgeon—I saw this case after the abscess had developed. The importance of this subject cannot be too greatly emphasized; but I feel that with careful study of the tonsils beforehand we shall not have the danger of the expression of cheesy material from the tonsils at the time of operation, with aspiration and subsequent complication. Dr. Claytor's remarks remind me that about five years ago I had a case of pulmonary abscess following operation on the ethmoid cells.

Dr. ELLIOTT: During the past three years I have seen five cases of pulmonary abscess following tonsillectomy. All of these patients were operated upon under general anæsthesia, and the question has arisen in my mind whether this may not be a great factor in the production of the abscess. I think it would be important if we could hear from some of those who have had experience as to whether any cases of pulmonary abscess have followed operations under local anæsthesia. Another factor is the operation itself. While some use a curved bistoury or special knife to separate the adhesions from the anterior and posterior pillars, most operators put the finger into the throat for this purpose. Such manipulation will surely empty out infected matter from the crypts. The five cases I have referred to were allowed to go a certain length of time to see if they would recover spontaneously. One did so. One still has a slight discharge, but the general health is very good at the end of a year and a half. Two died. The fifth was operated

upon, with drainage of the empyema associated with the abscess, which allowed sufficient collapse of the abscess cavity to secure relief, and this patient is now cured. This was a child of about 12 years of age. There is another complication similar to the one mentioned by Dr. Minor. I saw in consultation a patient with acute disseminated tuberculosis of both lungs. His tonsils had been removed some two or three weeks before. He had been at a sanatorium for two years, and had been considered an arrested case of tuberculosis for one year; his temperature was normal. He had a large pair of tonsils, and had been advised that it would be well for him to have them out. He consulted the best laryngologist in Toronto, and secured one of the best anæsthetists. He said he warned the larnygologist that he had tuberculosis and that the anæsthesia might be a serious matter. That man died five weeks after the operation with acute disseminated tuberculosis.

Dr. DUNN: Pursuant to what Dr. Elliott and Dr. Babcock have said I should like to say that I have seen only three cases of pulmonary abscess that gave a history of tonsillectomy, and in all three cases a general anæsthetic was given. In no case have I seen this complication following local anæsthesia.

Dr. DALAND: I have been much interested in this question for many years and also in observing the various operations done under the name of "tonsillectomy." When one recalls the extraordinary length of time that patients were formerly under ether; the slowness of the operation, the hæmorrhage, gagging, and choking, one can readily understand how easily an inspiration pneumonia could occur. But, as has been well said, the present-day operation is altogether a different thing. The operation now ordinarily takes only a few minutes—the two tonsils can be removed within five or six minutes. The operation is done in such a way that there is very little trauma—there should be none—and the entire tonsil is removed, leaving a clean base. The quickness of the operation, the absence of trauma, and the complete control of the field of operation makes it exceedingly unlikely that abscess of the lung will be a frequent complication in the future. I agree with Dr. Babcock that this complication is more likely to occur when a general anæsthetic is employed. In the adult I think that almost uniformly local anæsthesia is preferable. In children, however, the laryngologists cannot use a local anæsthetic on account of the child's resistance, and in such cases ether combined with oxygen may be given. The head is held low, there is little or no trauma, and practically no hæmorrhage, thus avoiding pulmonary complications.

Dr. MINOR: Speaking of the dangers of tonsillectomy in the tuberculous, I have had several cases of dissemination of tuberculosis following on tonsillectomy. I at present have a lady in my care whose tuberculosis began after a tonsillectomy. Some years ago I had a

patient who got into fine shape and went back to his professional work as a judge in Texas for two years and remained in perfect health. He had had, however, a pair of very ragged tonsils, which, when he was with me, I told him some day should come out. After two years of work and feeling perfectly well, he went to a local throat man and had them out. There was some tearing of the tissue; tonsil forceps were used to stop hæmorrhage; the patient went into a rapid dissemination, and was dead in six months. These are the only two cases of which I could recall many more. It is not that I do not believe in the value of tonsillectomy in these cases. I do believe in it, and I expect to use it in suitable cases in the future; but I must confess that I think it should always be done under local anæsthesia, and I think by preparing the tonsil beforehand by emptying the crypts, as has been suggested here to-day, ought to be an excellent thing and decrease the risk of dissemination.

Dr. MANGES: I should like to limit my remarks to the excellent papers by Dr. Richardson and Dr. Claytor. As regards the frequency of this unfortunate complication, I am sure it is much more frequent than any of us have any idea of. The fact that within a period of six months I should be able to observe six cases at one hospital, that the total number within the last two years should be nine, and that since writing my paper I should have seen a tenth case, shows that it does occur frequently; and if one observer can find ten cases in the City of New York, how many cases must be scattered through the country? I brought with me slides of this tenth case, which case I will narrate. The patient was a man who, with an obscure, unimportant lesion of the tonsil, the removal of which they thought might cure an obscure and ill-defined rheumatoid arthritis; he was operated upon at the leading throat hospital of New York City. And of the ten cases I have referred to, seven were not done at dispensaries by obscure practitioners, but at the Manhattan Eye and Ear Hospital by its skilled staff, and if this is what is happening at one of the best hospitals of New York, we may draw our own conclusions as to what occurs elsewhere. This tenth patient was operated upon; within ten days he was taken with chills and fever; a few days later profuse purulent expectoration developed, followed by septic fever. A large infiltration was found in the lower left lobe. He was treated for a while and then left the Beth David Hospital. He then came into the hands of a doctor who, having read my paper, brought him to me. At the Mount Sinai Hospital the examination showed the original patch, but soon two others developed in the upper left lobe, which in a short time developed into two large cavities, both filled with contents. In spite of all treatment his condition became more and more septic; as a last resort he was operated upon by Dr. Lilienthal, tying off the pulmonary artery. He died within twenty-four hours, being literally drowned in his own

secretion. Of our series of ten cases, three died, one of a cause I cannot relate, as he went out of our care; the second of a perforation of the cavity into the pleura, in other words, of an acute spontaneous pneumothorax; the third I have narrated. The remaining cases all went through a very severe ordeal; one after suffering for two years had to have part of the left lobe resected. If this is what happens in taking out a suspected tonsil, it is time we looked into the matter. I believe the etiology of this complication is squarely up to the surgeon. I believe it is entirely due to the aspiration of septic substances into the lungs at the time of operation. When I read my paper before the Section on Laryngology of the New York Academy of Medicine,* I took this view, which brought up a lively discussion. I do not favour the embolism theory, for, while it is an attractive theory, it does not place the responsibility or explain the facts. If we put this thing upon an embolic basis we get away from the point as to where to place the blame. Another point, and a very impprtant one, is that before these so-called slight operations the patients are not carefully examined. Many have temperatures beforehand—some have developed scarlet fever—showing that they were not given a thorough examination, as this is not considered necessary in this so-called minor operation. But to go back to the discussion at the Academy—Dr. Coakley brought up what I consider an important point in the etiology. He thought that the etiological factor was that at the time of operation the plugs in the tonsil, with their enormous collection of bacteria, were squeezed out, and were thus aspirated into the lungs. I want to emphasize this point. If we adopt the aspiration theory of lung abscess we shall put our finger upon the means whereby these unfortunate complications may be prevented. I would suggest, then, that before any operation is done on the tonsil these plugs should be squeezed out, or something done to make the field of operation such as we strive for in other operations—in other words, to give us a clean field. Of course, we cannot have an aseptic field, but if the tonsil is so prepared I believe we shall prevent a great many of these complications. One point more. There has been much discussion as to whether this operation is a dispensary operation or not. Mount Sinai Hospital has put itself squarely on record as insisting that, unless a patient can be given a few days' rest (twenty-four to thirty-six hours after the operation) such operations shall not be done in dispensaries. I believe we should all take this stand of regarding a tonsillectomy not as a minor operation. Secondly, that a tonsillectomy, as Dr. Richardson has so well put it, should not be done because we think it might be of help in some obscure condition. If you are going to do a tonsillectomy, be sure that the after-consequences will not be so grave that you will wish you had never entered the field.

* *American Journal of Surgery*, March, 1916.

Dr. Will Howard Swan (Colorado Springs) : In the discussions the tonsils have had all the blame for the pulmonary abscesses following. Dr. Claytor has spoken of nasal operations, and I should like to say that two days before I left home I saw a case of pulmonary abscess following resection of the nasal septum. I think the nasal operation should have its share of the blame.

Dr. P. K. Brown : I have had three cases of these complications in the last two years : one a small abscess that went on to cavity formation and discharged ; one that went on to caseous organization and had left a large scar in the lung ; and this last week a third case. Plates were taken five weeks apart, and you can see the rapid improvement in the upper left lobe of the lung. I want to call particular attention to a point which Dr. Minor has mentioned, that you cannot tell enlarged glands by the X-ray. The glands in the lower left hylus were remarkably enlarged, and subsided as the process in the upper left lobe improved. This case was interesting in connection with the whole problem of the relation of lymph glands to drainage.

Dr. Richardson : I wish first to speak of the etiology. I know, of course, that many think this is an inspiration or aspiration process, and no doubt many cases are of that nature. But there are also cases of embolic origin. That it is not only a question of aspiration is borne out by the fact that after operations on the sinuses I have yet to see or to hear of a case of abscess of the lung ; and in sinus cases blood is not only aspirated, but it is septic blood, because we put into it both bony tissue and granular tissue from the sinuses. Some cases are no doubt due to aspiration—where they commence immediately after the operation—but those cases which are not evidenced until a week or two weeks I think are embolic. And now in regard to the technique. This is one of the things we have to find out more about—one of the things we are searching for. Where is the fault? We have many diverse methods of doing tonsillectomies, and, if you will pardon me, it is interesting to hear men who do not do tonsillectomies talk about them. If they had to do some of them they would know that a tonsillectomy is not a simple operation. And why is it called a simple operation by the laity? Why do patients come to us expecting to be treated not as other operative cases, and when we suggest that they come into the hospital and undergo investigation say, "Why, is that necessary ; I thought I could have my tonsils taken out and go home and eat my dinner"? They do not get that from us, who do the work. But as to technique, some have advocated local anæsthesia and some general anæsthesia. One of the best operators in the country, a surgeon at Rochester, Minn., told me that he had had nine cases of abscess in the neck following local operative work, and one of these nearly became a mediastinal abscess, for which they had to go down to the clavicle. So you see that even under local anæsthesia we may have unpleasant complications. In regard to hæmorrhage, this is a factor which is

dependent as much upon blood clotting, &c., as it is upon the cutting of vessels; and whatever method you operate by you are occasionally going to strike a vessel that is going to bleed and cause trouble. And in the presence of a badly bleeding vessel whoever has done tonsillectomies knows that bleeding can best be checked under general anæsthesia. I want to reiterate that we are not talking only about abscesses of the lung due to tonsillectomies, but about those due to operations above the neck and from all causes—submucous operations, the removal of turbinates and things of that sort. And there is one thing I feel very strongly about, and I am going to appeal to you here. We send patients to you at your sanatoria whom we know have mild implication in the nose or throat, and in about two or three months we get a letter from the patient stating that the doctors at the sanatorium insist on having the tonsils taken out or straightening the septum. We do not operate at our offices because we think it is not wise to do so. There is one other point I wish to touch upon—scarlet fever. I want to make it plain that there is an intestinal toxæmia which sometimes follows tonsillectomy which is identical with the rash of scarlet fever. I have had two patients treated for scarlet fever when they have had nothing but this rash. As to the question of dispensary operations, I can use only one term. Such a practice, I think, is simply barbarous; and any man, either a general practitioner or a specialist, who will do this work in the dispensary, who will take out tonsils and allow the patients immediately to go home, is guilty of malpractice. The only way to do a tonsillectomy is to have out-patients under observation beforehand, properly prepared and properly placed on the operating table, operated on by whatever method you please, and then cared for in the hospital for at least four days. None of my patients ever leave the hospital as long as they show any temperature whatever—it may be for a week or more. Dr. Claytor referred in his paper to the occurrence of this complication in children. I do not say that one swallow makes a summer, or that one individual 14 or 15 years old makes a child—he is almost out of his adolescent period, almost a young man; and the statement I made as to the occurrence of this condition almost exclusively in adult life holds good. Please remember in thinking upon this subject that abscess of the lungs is not alone a complication of tonsillectomy. It occurs also after other operations. And I want to impress upon you the importance of realizing that tonsillectomy and other intranasal operations are not simple—that they have complications which are serious. Before you have these operations done think what you want to gain, and whether it is better to have the patient run the risk of the operation, with its possible complications, or to go on with what you know and to live in safety.

THE RÖNTGEN RAY IN THE DIAGNOSIS OF THORACIC DISEASES.

By JUDSON DALAND, M.D.
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The recent advances in the Röntgen diagnosis of diseases of the thoracic cavity encourage the belief that ultimately results may be expected comparable to those already secured in the diagnosis of diseases of the abdominal cavity. The Röntgen ray has already shown that phthisis may involve the roots of the lungs, and then spread along the inner border of the lungs towards the apex; or begin in the periphery of the lungs and spread centrically. Dr. Heise speaks of the former as peri-bronchial and the latter as parenchymatous. The study of anterior and posterior stereoscopic plates marks a most important advance in the diagnosis of pulmonary tuberculosis; multiple or successive plates, and those made at various angles of the body, and during held inspiration and held expiration, occasionally give information not otherwise obtainable.

Continued study of the exact condition of the walls of the bronchi, particularly as to thickening, gives promise of good results. Usually the Röntgen ray reveals more tuberculosis than is indicated by the physical signs, in this respect resembling the results of a *post-mortem* as compared with a physical examination.

In certain cases of acute pulmonary tuberculosis, charac-

terized by the presence of small, widely scattered areas of infiltration or consolidation, or when these lesions are deeply situated in the central portion of the lung, the X-ray reveals their presence when physical signs are doubtful or absent. Small serous or purulent effusions in the pleural cavity or between the lobes or under the diaphragm, occurring in tuberculosis, are often overlooked or diagnosed with difficulty; whereas they are usually detected by the X-ray. The mushy, indefinite outlines of fresh tubercular infiltration, contrasted with the sharp definite shadows of an old tuberculosis, is a new observation of diagnostic value.

The recent studies of Dr. Dunham, showing cone or fan-shaped and filmy or dotted markings on the plate corresponding to certain anatomic regions, the base of the cone at the periphery of the lung, marks an advance in Röntgen knowledge. The results of his further researches into the exact pathological conditions producing these shadows are awaited with great interest.

Dry pleurisy accompanying tuberculosis often produces fibrous material of varying thickness, binding the lung to the chest wall or diaphragm, or the lobes to each other, and may be recognized by the plate and escape detection by physical signs.

The röntgenogram is important as a permanent record, permitting a minute study of the size and topographical distribution of tubercular processes.

Accurate knowledge of the progress or recession of tuberculosis, or of complications, may be acquired by comparing plates made at varying intervals. Small single or communicating cavities, more or less centrally situated in the upper lobe or elsewhere, may be accurately diagnosed by the X-ray when their presence and location may otherwise be in doubt. Moreover, the question as to whether the

cavity drains properly or not may sometimes be answered. Bronchiectasis, circumscribed or diffused, may likewise be diagnosed. Although enlarged glands in and about the roots of the lungs are usually tubercular, they may be produced by many other causes; and when few in number and small can only be diagnosed by the ray.

In order to progress in the interpretation of plates showing pulmonary tuberculosis, it is necessary to increase the refinements of technique, to organize new methods, and to employ information possessed by the clinician and pathologist. The fluoroscope may give new information or valuable aid to the interpretation of the röntgenogram.

The signs obtained by physical examination possess added value when considered in conjunction with the history, the presence or absence of fever, loss or gain of weight, cough, expectoration, hæmoptysis, and the presence or absence of tubercle bacilli, &c., and, in like manner, the best interpretation of a plate, from a case of pulmonary tuberculosis, is obtained when the röntgenologist joins his observations with those of the physician. The pathologist usually secures material for study from a patient after he has died of tuberculosis; whereas the röntgenologist, like the physician, observes the course of the disease from the beginning to the end. The pathology that concerns the röntgenologist is what may be called living pathology, which is seldom seen by the pathologist. Pathological knowledge has been increased and made more accurate by the study of fresh tissue obtained at operation; and a like advance may be expected when the pathology of the living is studied in relation to the results of Röntgen examination.

Pathology must be re-studied before complete interpretation of X-ray findings are possible. The pathologist must give special consideration, not only to histology and

bacteriology, but also determine the exact size, shape, location, and density of pulmonary lesions, as shadows on plates are due to differential densities.

Giffin[1] and Sheldon have shown that almost every case of pulmonary tuberculosis, with tubercle bacilli in the sputum, can be diagnosed independently by the röntgenologist; that in many cases where the sputum contained no tubercle bacilli, and the Röntgen diagnosis was positive, the subsequent history corroborated the Röntgen diagnosis.

The present status of the Röntgen diagnosis of pulmonary tuberculosis is most encouraging, and in the future will become more and more exact.

Whenever phthisis is suspected, or where the physical signs and clinical evidence are doubtful, a Röntgen examination is absolutely necessary. Although pulmonary phthisis is often easily diagnosed by clinical methods, nevertheless, the Röntgen ray so frequently reveals new or unexpected conditions, that in the future no case will be considered as having been thoroughly and completely examined without a Röntgen examination.

Metastatic carcinoma or sarcoma, when small and scattered, may escape recognition by ordinary diagnostic methods, and yet be easily recognized by the ray; and in a similar manner persistent or enlarged thymus or mediastinal tumour may be diagnosed.

Röntgen therapy is still in its infancy. Encouraging results have already been observed in pulmonary sarcoma. The effects of intensive doses of the ray by cross firing upon other forms of pulmonary disease, as chronic pneumonitis, for example, is the work of the future.

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[1] H. Z. Giffin and W. D. Sheldon (Rochester, Minn.): "Clinical and Röntgenological Findings in Pulmonary Tuberculosis," abstract, *Journ. Amer. Med. Assoc.*, 1915, vol. lxiv, p. 1878.

DISCUSSION.

Dr. DUNN: I have just one thing to say and one plea to make. There is a definite characteristic shadow shown upon the stereoscopic plate which is characteristic of tuberculosis. And if you will look for that marking you will have a means of checking up your physical diagnosis. When I first brought out my work in 1910 it was based entirely upon this, as checked up by these plate findings. Six years later it is based upon pathological findings. It is not a minute's work—there is a great deal of it. But I want to tell you what those specific findings are. They are a triangle—or a fan or cone—seen upon the stereoscopic plate, with the base of the triangle towards the periphery or pleura, and the apex pointing toward the hylus or roof of the lung; and usually that fan-shaped shadow is connected to the hylus by a heavy trunk. Those are the objective findings which should be found upon your stereoscopic plates before you make a diagnosis of tuberculosis. One more thing—it does not mean miliary tuberculosis, it does not mean bronchial or peribronchial tuberculosis, nor does it represent glandular tuberculosis. Those are the markings of chronic tuberculosis—usually found at the apex of either the upper or lower lobe. To study those markings you have to know the trunks radiating on the normal chest plate. After you have found these normal trunks and know what they are, the triangle will come to you if you look for it—as you have to learn to look through your microscope. Those are the markings of the cases that are coming to our clinics and sanatoria, the cases that are commonly spoken of as consumption. They may be early, they may be late. The density is that of all infarcts, but the infarct is of a much more homogeneous character in tuberculosis than in other conditions. The density I have described may be heavy, it may be light—there are a thousand different densities—but it must necessarily be more in one side, at the end of one trunk, than at the other. When you have a density that goes all the way down as though it was a general distribution you can look for some other etiological factor. When it is tuberculosis it starts at one or another apex or trunk, and more at that place than at another. That is the finding that is characteristic of tuberculosis. But the process must go out to the pleura. Those roots and trunks which radiate out a little way are not characteristic of tuberculosis. But the markings I have described are characteristic of pulmonary tuberculosis. They check up with the physical findings and with the lung taken out of the chest. The last point—to what are those densities due—had been the stumbling-block. At first we thought they were due to a fibroid change. But I know now that they are not due to a fibroid change. After cutting serial sections with Dr. . . . I know that they are due to tubercles—not one, not

two, but myriads of tubercles scattered all along the bronchial tree, extending all the way out to the pleura. It is a large problem to say how these tubercles got there; but there they are, and they are the cause of these characteristic shadows. I will ask you to look for that triangular shadow in these certain places. It must be done by stereoscopic plates. You cannot trace them by a single plate. Dr. Hamman explained to me that the stereoscopic plate is nothing but a refinement of the single plate. Gentlemen, it is not a refinement — it is an absolutely different method of reading your plates. It is based upon a pathological condition that the X-ray can determine for you. It is an instrument of precision for the recording of differences of density — and we get through it true markings characteristic of tuberculosis — which are just as true as the picture which Flint gave, and just as true as the stethoscope as given us by Laennec. No one of them single will carry the day. We cannot always be right—we must sometimes make mistakes—I make mistakes, perhaps because I do not read the plates correctly; but it is such a tremendous advance that no one who has worked in the laboratory or followed these lungs to the *post-mortem* room can deny for one moment the great value of this method.

Dr. MINOR: I recognize the beautiful work done by this method, and I appreciate the finer diagnosis in difficult cases; but those are the exceptional cases. My own view is that in the majority of cases the fluoroscope will give satisfactory information to enable one to round out the general physical diagnosis. In a difficult case this will have to be supplemented by facts which nothing but the stereoscopic plates can give. But in nine cases out of ten, I think, the fluoroscope is the thing to use, along with the physical examination.

Dr. ELLIOTT: Might I ask Dr. Dunham if all of his primary examinations are made with stereoscopic plates. If we are going to use this method it is going to mean an enormous expense, and it would be rather difficult to adopt it in all our clinics. We have been making primary examinations by means of the fluoroscope, and if the fluoroscope shows shadows we then go on to the stereoscopic or other plates. I should like to hear some expression of opinion from the fellows of this Association as to the value of the fluoroscope—whether we should not use it in every case as a preliminary method and then follow it up with the stereoscopic picture if indicated?

Dr. SHURLY: For many years it has been my privilege to work in the diagnosis of diseases of the chest with one of the pioneer röntgenologists in the state of Michigan, and I have watched with great interest the gradual improvement in technique and the development of our knowledge in comparing all the clinical findings with the findings from the plates. A statement has been sent broadcast that the röntgenologist will soon eliminate the clinician, and that the röntgenological

diagnosis will suffice for the general practitioner. There is a tendency among practitioners to accept the reading of the röntgenological plate and eliminate all the wonderful findings of physical diagnosis. We recognize, of course, that the röntgenological findings can be nothing more than a diagnostic aid, and yet as such they are of very great importance. Dr. Daland has said that it is absolutely necessary to have such a reading for a complete study of the case; and, of course, that is very largely true for many of the border-line differentiations. But only in the border-line differentiations is it a matter of necessity. Of course, the röntgenological plate does not diagnose tuberculosis in its activity; it remains for the physical diagnostician, with his judgment and common sense, with his knowledge of the differentiations of diagnoses, and with his psychology, to work out the proper finding in a particular case. I, for one, should like to speak with the very greatest emphasis of the current tendency of the general practitioner to eliminate the wonderful art and science that belongs to physical diagnosis.

Dr. Rochester: I should like to say a word in regard to the regular use of the fluoroscope. For the last eighteen months I have used it in every case, and in certain cases have taken a plate. I always make my physical examination first, and record it, before I look at the fluoroscope. And the fluoroscope has shown me certain things that were not brought out in the physical examination, and vice versa. In the cases in which I have found out nothing by the fluoroscope I have had plates made, and these have seldom given me findings.

Dr. Daland: One of the most important advances in the diagnosis of thoracic disease by the Röntgen ray is the study of anterior and posterior stereoscopic plates, which requires much time and thought. I agree with Dr. Shurly that there has been a tendency on the part of certain practitioners to depend entirely upon the plate and to ignore the physical signs. This, however, is a fault of the physician. So far as the ordinary every-day case of pulmonary tuberculosis is concerned, the diagnosis is easy; but even in such cases — even when the physical examination has been made by an able, well-trained expert — every now and then an unsuspected complication, such as an interlobar collection of pus, is discovered by the Röntgen ray which was not revealed by the physical examination. Therefore occasionally new information may be secured by the use of this additional method of physical diagnosis, for the X-ray is a physical agent. The fluoroscope is of importance in the study of tuberculosis, pneumonia, tumours, pleuritic effusions, including pneumothorax, the position and movement of the diaphragm, emphysema, the size, position and action of the heart and effusions within the pericardium. I have not obtained the same satisfaction from its use in beginning tuberculosis as Dr.

Minor, and attach more importance to the rontgenogram. Rontgenology is a speciality in medicine, and most practitioners and internists find it necessary to confine themselves largely to fluoroscopy, occasionally making plates of ordinary conditions but relying upon the aid of the rontgenologist in all doubtful or serious cases. I am glad that Dr. Dunn emphasized the importance of cone-shaped alteration in density in the diagnosis of early tuberculosis.

THE DIAGNOSIS OF PULMONARY TUBERCULOSIS WITHOUT THE STETHOSCOPE.

By H. LONGSTREET TAYLOR, M.D.
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The successful treatment of pulmonary tuberculosis depends primarily upon an early diagnosis. This statement has been made so often and in such a variety of ways that its repetition becomes trite, and yet the enormous importance of the subject makes it necessary to call the attention of the profession to these old axioms again and again, and by repeated blows try to drive the nail home. The morbidity caused by tuberculosis is enormous. If recognized and untreated the morbid process advances, and constitutional strength becomes more and more impaired by the progress of the disease until the prognosis is absolutely hopeless. It has been the fashion to blame the medical profession for the existence of this huge army with an unrecognized communicable disease, but they are not alone responsible, although at times and in certain instances they have certainly been remiss. The disease itself, on account of the insidious character of its onset, deludes its victims into believing that they are not seriously ill, and do not require the services of a physician. In this class of cases—and their name is legion—the profession can in no wise be held responsible for the late diagnosis. Many patients, too, are

reluctant to go to a physician lest their fears should be confirmed, and they would leave the consultation room knowing that they were victims of the great white plague.

The number of unrecognized cases can be demonstrated in various ways: by autopsies of persons who have died of other diseases, or who have met violent deaths, which show an active or healed pulmonary tuberculosis in a surprisingly large number of cases. Careful physical examinations of large numbers of men applying for the Army or Navy, routine examinations of employees, or life insurance examinations frequently discover cases formerly unsuspected. Then, again, the diagnosis of an incipient case of pulmonary tuberculosis is an exceedingly difficult one to make if the case is truly an early one. Physical examination of such a case can reveal but little, as the signs are not pronounced and easy of detection until actual destruction of the tissue of the lung has taken place; but given a young adult with vague and indefinite indications pointing to pulmonary tuberculosis, the chances are decidedly in favour of tuberculosis being present, since it is an exceedingly common disease at this age, and the profession should not hesitate to make a tentative diagnosis of pulmonary tuberculosis subject to the result of subsequent tests. The absence of tubercle bacilli from the sputum proves absolutely nothing, and their presence in the sputum shows that an early diagnosis has not been made. It is my personal impression that the profession is too prone to rely upon the laboratory report of the examination of the sputum almost entirely in making the diagnosis of pulmonary tuberculosis to the exclusion of a careful study of the clinical picture presented by the individual case. Laboratory tests "with the glamour of science and the romance of novelty" cannot supplant entirely the study of each individual with

the sharpened observation due to long acquaintance with the danger signals thrown out by this enemy while digging himself in and preparing for a long siege, which, unless skilfully combated, is destined to end in the fall of the individual and his unconditional surrender to the captain of the forces of death. The laboratory has proved itself of immense value to the profession, but, like everything else, is not infallible, and in the question under discussion has too often delayed a positive diagnosis, which should have been made by a careful analysis of the patient's symptoms and a painstaking exclusion of other possible conditions. We have to deal with a bacterial disease, with a local expression and a number of constitutional manifestations, which show the disturbed balance between the virulence of the pathogenic bacteria and the specific resistance of the individual. On the other hand, there are rare cases in whose scanty sputum tubercle bacilli may be found, but whose chest is negative even when examined with the greatest care. The diagnosis must often be made in the absence of signs in the chest by the exclusion of other toxæmic conditions that may resemble the symptoms of the tuberculosis toxæmia. These symptoms may not suffice for a positive diagnosis, but they arouse suspicion, and Pottenger has very wisely told us that the most important thing for the clinician is to know when to suspect the presence of tuberculosis. The cases fall into one of the following categories :—

Neurasthenic Onset.

Nervous depression, insomnia, and gastric disturbances are frequently the first symptoms in those cases with an insidious onset. There is nothing peculiar or characteristic about their symptoms. The hope that knows no failure and

sees no rocks ahead is the product of the toxæmia of the more advanced stages, and is not observed in the early stage.

There is no characteristic peculiarity in the dyspeptic symptoms of the incipient case, but the digestive function is apparently inhibited to a greater or less degree in many cases by the toxæmia of tuberculosis at its earliest beginnings.

Anæmic Onset.

Another group of cases belonging to the class of those with the insidious onset are characterized by anæmia or chlorosis, which constitutes the only evidence that there is anything abnormal about them. In this group it is well to remember Pottenger's advice and learn when to suspect tuberculosis, or the diagnosis will not be made until the case is far beyond the boundaries of incipiency.

The Hæmorrhagic Onset.

Fortunate, indeed, are those whose tuberculosis comes out of ambush and attacks in the open, if their physicians have learned that a pulmonary hæmorrhage in ninety-nine cases out of a hundred means tuberculosis.

The ingenuity that many physicians expend in trying to prove to their patients that the blood they have spat up has not come from the lungs and is of no consequence has been repeated, often years afterwards, when the patient's lost opportunities are only too apparent, due to the bad advice received, when a proper understanding and handling of the case would have probably meant a life saved. It is quite true that often after this preliminary warning of hæmorrhage a long time may elapse, even years, before it is repeated,

or before an active progressive tuberculosis sets in. But what precious time this would have been to the patient if only a small part of it had been properly used in overcoming the disease at once before it secured a strangle hold on its victim. "Twice-told tales" these truly are in many consulting rooms, where their ghastly significance and constant recurrence are most depressing. Until the profession takes the trouble to learn how to recognize the beginnings of pulmonary tuberculosis, and until students are taught the same lesson in a convincing manner, what prospects have we of lessening the spread of this communicable disease?

Onset with Fever.

The toxæmia of tuberculosis produces a characteristic temperature curve, which should at once focus attention upon tuberculosis, if the physician had the temperature curve to inspect. How seldom he has outside of a hospital. A slight evening rise of temperature, possibly subnormal in the mornings, with pulse-rate at all times faster than normal, is a danger signal for those who appreciate its significance. With the increased evening temperature, accelerated pulse-rate, slightly debilitated, easily tired and somewhat short-winded patient, with a tendency to what he calls dyspepsia, especially if the presence of a slight hacking cough in the morning can be assured (it is often overlooked and denied by the patient himself), then we have a typical picture of a beginning case of pulmonary tuberculosis, in whom the diagnosis is practically already made.

The Pleuritic Onset.

Pleurisy is another route which tuberculosis often chooses in its advance on its victims.

The French School years ago insisted that every pleurisy was due to tuberculosis. While this is probably too sweeping a generalization, yet it behoves us to take it into consideration in every case, more especially in those in whom the recovery is prolonged, or in whom the pleurisy becomes chronic and no resolution takes place. In such cases the physician is not dealing with a probability merely, and the patient must remain negative to all the tests to prove that he is not already a consumptive.

The Pneumonia Onset.

Acute cases not infrequently follow a pneumonia, which in every way resembles croupous or broncho-pneumonia, except that it goes on without crisis or lysis, and merges into an attack of pulmonary tuberculosis. Every unresolved pneumonia should be carefully studied with this possibility in view.

The Laryngeal Onset.

Every patient with a hoarse voice and an intractable cough that persists over two weeks should be suspected of having tuberculosis. The larynx may present only the appearance of an acute catarrh, but soon more or less infiltration of the arytenoids can be made out, or the interarytenoid region shows the dreaded swelling and serrated upper edges so characteristic of laryngeal tuberculosis, or ulcers appear on the false cords or the upper surface of the cords themselves.

The protean manifestations are too numerous to mention here, and are as uncertain as the old idea of the universal anæmia of the larynx in tuberculosis, which is not true in those cases in which laryngeal symptoms are the first to be observed.

To recapitulate the symptoms which should arouse suspicion of the presence of tuberculosis and lead to a thorough study of the case, we have first and foremost cough, especially on arising in the morning, at which times there may be a few short coughs, with or without any expectoration. At the same time the patient may be conscious of a slight degree of debility, and the fact that he tires more readily than formerly, that he has lost a little weight, that his dyspeptic symptoms have grown more annoying. The significance of hæmorrhage has been spoken of above as a persistent tickle in the throat, which gives rise to an uncontrollable cough, accompanied by a slight hoarseness. A slight fever and rapid pulse, with or without chills and sweating at night, point unmistakably to the necessity of thoroughly testing the patient for the presence of tuberculosis, and the same is true of anæmic conditions not otherwise accounted for and of protracted convalescence from an acute disease. Although not a disease, yet pregnancy and labour come in under this category, and every woman with latent tuberculosis is especially liable to have it become active after childbirth. Many cases of tuberculosis masquerade under the name of influenza.

The tests that the patient should be subjected to are, in the first place, of course a skilful physical examination, but even this may give negative results, as pointed out by Cabot in his "Physical Diagnosis." Then comes the proper interpretation of the X-ray findings, of an auto-inoculation test, and of a tuberculin test. As none of these tests may be decisive, we are constrained to put the patient under skilful observation for a time which will enable us to make the correct diagnosis.

The object of this paper is to emphasize the fact that the

profession does not give the proper value to the careful study of the patient's history, and delays making even a provisional diagnosis until the stethoscope or the microscope reveals the condition. No more convincing argument has ever been made on this subject than that contained in the following passages from Marcus Paterson's "Auto-inoculation in Tuberculosis":—

"A patient may be suffering from pulmonary tuberculosis, as is proved by the presence of tubercle bacilli in his sputum, without having any definite physical signs. The stethoscope here is of no value. Again, he may have definite physical signs, whilst his sputum is entirely free from tubercle bacilli.

"I was trained to diagnose, treat, and give a prognosis in a case of febrile pulmonary tuberculosis by means of the stethoscope alone. I have since come to the conclusion that the value of the stethoscope has been largely overrated, and I am convinced that too much significance has been attached to the local condition, and that not nearly sufficient attention has been given to the state of the blood and the general health of the patient.

"We do not in other bacterial diseases attach as much significance to the local disease as we have done in tuberculosis. Take, for example, diphtheria. Does any physician consider himself in a position to declare after an examination of the throat alone, either that the patient will recover or that he will die? Similarly in typhoid fever the local ulcers may kill the patient by perforation; but, as a general rule, they appear to matter little to the individual in comparison to the general toxæmia."

The lesson from all of this is that a diagnosis of pulmonary tuberculosis can be made from the patient's history and symptoms, and should be made—at least in the

physician's mind—before the chest is bared for an examination. In this way a man who is not constantly making chest examinations, or the man whose hearing is defective, need not hesitate about making a provisional diagnosis of pulmonary tuberculosis. It is far better to suspect a patient of having tuberculosis who is free from it than to give a clean bill of health to one whose chest is negative, but in whose lung tubercles are developing. A period of careful observation and the use of the various tests, especially the auto-intoxication test, will soon remove all doubt.

SYPHILIS OF THE LUNGS.

By N. K. WOOD.
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The finding of extensive dulness of the lungs during routine examinations in cases that did not show tubercle bacilli in the sputum has interested me to collect data that would point to some other cause than tuberculosis for such dulness.

At the same time the recognition of the *Spirochæta pallida* and the discovery of the Wassermann test have proved pathological findings, not heretofore recognized as such, a manifestation of syphilis. A striking example of what I mean is aortitis.

Therefore the question suggests itself, Can the prevalence of lung dulness be correlated with the prevalence of syphilis? Can sufficient evidence be found clinically to justify a diagnosis of syphilis of the lungs? Is that evidence of sufficient weight to convince the pathologist that he is overlooking something or calling something already seen by a wrong name?

From twenty-two cases I have selected a series with histories suggestive of syphilis whose physical examination showed definite lung impairment. If the Wassermann test proved positive, I had sputum examinations made and von Pirquet tests tried. If these proved negative, I had radio-

graphs taken of the chest and long bones of the lower leg. I was able to select seven cases that showed definite histories, definite lung impairment, positive Wassermanns, negative sputum and von Pirquet tests.

To these were added four cases which did not meet the above requirements. One had a few tubercle bacilli in the sputum, Gaffky +2, but had in addition a markedly positive Wassermann test and definite radiographic findings. The three others were children, upon whom the diagnosis of tuberculosis had been made, and who had been carefully treated for tuberculosis several years. Repeated examinations of their sputum have shown no tubercle bacilli, but their family histories were strongly suggestive of syphilis. No Wassermann tests or radiographs were made upon them, but I wish to cite them because of the marked effect which mixed treatment had upon them.

Case 1.—W. J., male. January 29, 1915.

F. H.—Could not be obtained.

P. H.—Gonorrhœa twice. Hard chancre.

P. I.—Pains in abdomen. Cough and expectoration. Constipation.

P. E.—W. d. and n. Skin negative. M. M. pale. Teeth bad. General glandular enlargement. Lungs: Marked dulness in upper two-thirds and moderate dulness lower third in front. Rare crackles left top. In back, few medium crackles above the spine scapula. Harsh respiration from the apex to the angle of scapula. Right back, diminished respiration upper half with few dry râles. Fairly good respiration lower half. Heart: Not enlarged. Action regular. First sounds weak. No murmurs. P^2 plus. Liver: Edge felt $1\frac{1}{2}$ cm. below costal margin. Old scar of the penis. Sputum: Negative. von Pirquet: Negative. Wassermann: Positive. Radiographic findings: Clavicles; lower ribs and tibiæ show periostitis and endostitis. Chest: Aortitis. Infiltration lower third right lung. Weight: 125 lb.

Treatment.—Tr. nux and gentian before meals. Mercury and potassium iodine after meals.

July 31, 1915.—Has had a good month. No pain in abdomen for six weeks. No cough. Bowels move well. Eats and sleeps well. Weight: 132½ lb. Lungs: Dulness in front remains the same. Respiration distinct. Fair excursion. Rare dry râles at apex left side. In back, dulness has decreased on the right side. Respiration is heard easily; excursion good; no râles. On left, broncho-vesicular upper half. Good lower half. Few dry râles upper half.

February, 1916.—Has improved since last note. Weight: 135 lb.

Case 2.—C. M. Female, aged 55. Single. March 19, 1915.

F. H.—Father and mother died when she was very young. Six brother or sisters died before 1 year old.

P. H.—Heart and kidney trouble seven years.

P. I.—Loss of appetite and strength, pains in joints, headaches, constipation, chronic cough with expectoration, and shortness of breath. Poor memory.

P. E.—W. D., p. n. Skin pale. M. M. pale. Teeth poor. General glandular enlargement. Chest small and flat. Clavicles and ribs prominent. Lungs: Marked dulness both lungs throughout, right more than left. Bases filled with moist râles. Musical râles the upper half. Respiration faint over upper half. Poor excursion throughout. Heart: Right border 4 cm. to right of mid-sternal line. Left border 13 cm. to left of mid-sternal line. Action very irregular, sounds faint, no murmurs. Liver felt 2 cm. below costal margin. Œdema of ankles. Sputum: Negative. von Pirquet: Negative. Wassermann: Positive. Radiographic findings: Both fibulæ show periostitis. Chest: Very large heart. Weight: 157¼ lb.

Treatment.—Tr. nux and gentian before meals. Mercury and potassium iodine after meals.

March 25, 1915.—Feels very much better. Very little cough. No œdema of ankles. Less headache. Lungs: Few medium dry squeaks scattered over entire right, and rare dry râles over left.

February 5, 1916.—Slow and steady improvement. Looks and feels decidedly better. Weight: 168 lb. Memory im-

proved. Lungs: Few rare, sonorous râles in upper half of both fronts and over the entire back. Dulness the same. Heart: Slightly irregular. A short presystolic murmur has developed.

Case 3.—W. P., male, aged 35. Married. February 23, 1915.

F. H.—Father died of tuberculosis. Mother alive and well. Two sisters died as babies. Four brothers and one sister alive and well.

P. H.—"Brain fever" age of 13. Rheumatism twice, last time eight years ago. Several quinsy sore throats. Has two children, both poorly developed and poorly nourished. Has lost no children.

P. I.—Ten weeks ago spat up half-cupful of blood. Blood-streaked sputum for next three days. No more blood until three days ago. Since then blood-streaked sputum. Cough for one month before first hæmoptysis, then none until five days ago. Best previous weight 141 lb. sixteen years ago.

P. E.—F. d. and p. n. Skin pale. M. M. pale. Teeth poor. Glandular enlargement marked. Chest narrow. Clavicles prominent. Lungs: Marked dulness upper two-thirds of both lungs in front. Broncho-vesicular respiration right top. No râles in front. Marked dulness both backs throughout. Broncho-vesicular respiration upper half. Diminished respiration lower half. Few medium crackling râles left back from angle of scapula to base. Heart: Right border, right edge of sternum. Left border, nipple line. Liver: Not felt. Sputum: Negative. von Pirquet: Positive. Wassermann: Plus plus. Radiographic findings: Clavicles, three lower ribs, tibiæ show periostitis and endostitis. Chest: Infiltration both apices. Weight: 127 lb.

Treatment.—Tr. nux and gentian before meals. Mercury and potassium iodine after meals.

March 6, 1915.—Tubercle bacilli found in sputum, Gaffky + 2. Weight: 126½ lb.

Treatment.—*Idem.* Patient allowed to continue at work.

April 14, 1915.—No tubercle bacilli found in sputum. Feeling very good. No blood-streaked sputum since February 26, 1915. Coughs much less, and raises only in the morning. Weight: 132 lb.

April 28, 1915. Feeling very well. Coughs rarely, and only when he has to raise sputum. Raises less than 1 dr. in twenty-four hours. Weight: 136½ lb. Lungs: Dulness upper half both lungs in front. Good respiration. Few to rare, fine and medium stretching sounds both bases. In back, dulness persists. Diminished respiration lower two-thirds on left. Rare, medium, stretching sounds at base. On right, diminished respiration; lower half, fairly deep respiration; rare stretching sounds scattered all over back. Sputum: No tubercle bacilli found in sputum.

June 9, 1915.—Says he feels as well as he ever did in his life. No cough, no expectoration. Lungs: Respiration good. Excursion good. No râles heard. Weight: 141 lb.

August 3, 1915.—Weight: 143 lb. Slight cough in the morning.

February 3, 1916.—Has taken no medicine since August. Has felt well until the last few weeks. Now has choked-up feeling in chest. Is coughing and raising. Weight: 133 lb. Lungs: Marked diminution of dulness throughout both lungs. Front right apex rare fine crackle. Rare dry râles left apex. Good respiration. Good excursion. Back, diminished respiration left top. Rare, fine and medium stretching sounds upper half. Rare, fine and medium stretching sounds with cough to mid-scapula on right. Good respiration and good excursion entire right side.

Treatment.—Resume mixed treatment.

March 9, 1916.—Weight: 136 lb. Choked-up feeling has disappeared. Cough, and raises rarely.

Case 4.—M. C., female, aged 35. Married. March 10, 1915.

F. H.—Father and mother living. Two brothers and five sisters living. Three brothers died in infancy before 2 years old.

P. H.—Has had seven children. Three have died, one with diphtheria, two malnutrition, aged 4 and 5 months respectively.

P. I.—Past four weeks headache and nausea. Poor appetite. Fatigue. Very constipated. Best weight: 112 lb. fifteen years ago.

P. E.—P. d. and n. pale. M. M. pale. Teeth bad. General glandular enlargement. Chest small. Clavicles

prominent. Lungs: Marked dulness throughout both chests. Faint respiration. Limited in excursion. Whispered voice plus over the right upper lobe. Rare, dry squeaks right mid back. Heart: Right border mid-sternal line. Left border one finger breadth inside nipple line. Sounds weak at the base. No murmurs. P^2 plus. Liver: Not felt. Sputum: Negative. von Pirquet: Negative. Wassermann: Positive. Radiographic findings: Bones show nothing. Chest shows nothing. Weight: 85 lb.

Treatment.—Tr. nux and gentian before meals. Mercury and potassium iodine after meals.

June 30, 1915.—Weight: 88 lb. General condition much improved. Pale and under weight. Lungs: Dulness persists in lungs. Respiration fairly good in front. Diminished in back. Excursion good in front and fair in back. No râles.

March 14, 1915.—From December 4, 1915, to January 27, 1916, was given injections succinamide of mercury, $\frac{1}{5}$ gr. Since then has felt very well. Weight: 94 lb. Lungs: Continue to show dulness, but good respiration.

Case 5.—E. W., female, aged 36. Married. April 8, 1915.

F. H.—Negative.

P. H.—Asthma and bronchitis several years.

P. I.—Cough all winter. Poor appetite. Loss of 10 lb. last few months.

P. E.—F. D., f. n. M. M. pale. No glandular enlargement. Chest barrel-shaped. Lungs: Marked dulness throughout both, especially upper two-third. Harsh respiration throughout. Some to few, medium and coarse, wheezing râles over entire chest, front more than back. Heart: Cardiac area normal. No murmurs. Sputum: Negative. von Pirquet: Negative. Wassermann: Positive. Radiographic findings: Bones show nothing. Chest shows nothing. Weight: 107 lb.

Treatment.—Tr. nux and gentian before meals. Mercury and potassium iodine after meals.

July 30, 1915.—Temperature, 99·2° F. Weight: $112\frac{3}{4}$ lb. Feels very much better. No cough. Has raised nothing for eight weeks. Lungs: Much less dulness. Right front few, fine and medium, squeaking râles with cough, scattered over

entire side. On left, rare, fine and medium, dry squeaks, with cough scattered over upper half. In back, few fine, medium and coarse, squeaking râles, with cough scattered over both sides, top more than base.

September 2, 1915.—Weight: 119¼ lb. Feels very well. No subjective symptoms referred to chest. Lungs: Clear throughout.

Case 6.—G. A., male, aged 22. Single. March 26, 1915.

F. H.—Negative.

P. H.—Severe pneumonia in childhood affecting left side. Gonorrhœa and chancre.

P. I.—Bad cough for two months. Feels weak. Has lost 10 lb. in two months. Occasional night sweat. Raises thick, yellow sputum.

P. E.—W. D. and N. Good teeth. General glandular enlargement. Chest: Good size. Lungs: Very marked dulness over entire left side and marked dulness upper two-thirds of right. Moderate dulness lower third. Faint respiration over left side. Râles scattered throughout left. Heart: Right border mid-sternal line. Left border not determined. Liver: Edge felt. Is tender. Sputum: Negative. von Pirquet: Negative. Wassermann: Plus plus. Radiographic findings: Periostitis of bones suggested. Chronic pleuritis of left lung. Weight: 122 lb.

Treatment.—Tr. nux and gentian before meals. Mercury and potassium iodine after meals.

May 25, 1916.—Has improved but little. Feels weak and tired. Pain in the left axillary region. Lungs: Dulness persists. Good respiration on right side. Few to rare, fine clicks scattered over lower half. Left front, bronchial respiration fourth space. Some to few, fine and medium, sticky râles or pleuritic rubs with cough. Left back, few fine, medium, sticky râles with cough to spine. Some fine, medium and coarse friction rubs from spine to angle. Few fine and medium, pleuritic rubs from angle to base.

April 13, 1916.—Has taken treatment regularly. Wassermann test negative. Weight: 142 lb. General condition excellent. No cough. No expectoration. Lungs: Marked dulness persists over left. Some dulness on right. From above down on left, few, some to considerable fine, medium

and coarse friction rubs front and back. Few fine friction rubs at base of the right.

Case 7.—C. S., female, aged 52. Married. October 1, 1914.

F. H.—Husband died from shock at the age of 63.

P. H.—Has had six children. One died at 3 months, one at 5 months, one at 1½ years old. The latter, however, of diphtheria. Dizziness and headaches occurred at three or four days' intervals for several years.

P. I.—Increasing attacks of the above. Dizziness is more severe and lasts longer.

P. E.—W. D. and f. n. Glandular enlargement. Poor teeth. Chest small. Clavicles prominent. Lungs: Show slight dulness upper half and front, and marked dulness from the spine to the angle of scapula both backs. Rare, dry râles left back. Heart: Right border, right edge of the sternum. Left border, nipple line. Loud systolic murmur at apex transmitted to axilla. Liver: Edge felt. Sputum: Negative. von Pirquet: Negative. Wassermann: Positive. Radiograph findings: Periostitis and endostitis of the tibia. Chest, aortitis. Weight: 135 lb.

Treatment.—Tr. nux and gentian before meals. Mercury and potassium iodine after meals.

June 21, 1915.—Feels very much better. Very little headache. No dizziness. Sleeps well. Weight: 146½ lb. Chest examination practically the same.

July 26, 1915.—Has taken no medicine for four weeks. Feels well. Weight has dropped, however, to 142½ lb. Lungs: Clear throughout. Good respiration. Good excursion.

January 21, 1916.—Has taken medicine irregularly. Feels rather poorly. Weight: 140 lb.

May 1, 1916.—Has taken medicine regularly last two months. Weight: 142¾ lb. Feels very much better. Lungs perfectly clear.

Case 8.—M. G., female, aged 37. Married. Coloured. April 22, 1915.

F. H.—Negative.

P. H.—Two children. Two miscarriages.

P. I.—Twelve years pain in left lower quadrant. Worse

on exertion and when constipated. Loss of 12 lb. in last five months. Slight cough and expectoration.

P. E.—W. D. and W. N. Teeth bad. No glandular enlargement. Lungs: Moderate dulness upper two-thirds of both. Good respiration. Good excursion. Few scattered râles right back. Heart: Right border, right edge of sternum. Left border, nipple line. Systolic murmur over the right side of the heart at apex; not transmitted to axilla. Abdomen: Tenderness lower left quadrant. Tube: ? Sputum: Negative. von Pirquet: Negative. Wassermann: Positive. Radiographic findings: Tibiæ suggestive. Aorta suggestive. Heart very large. Weight: 167¼ lb.

Treatment.—Tr. nux and gentian before meals. Mercury and potassium iodine after meals.

May 27, 1915.—Has had occasional night sweats. Does not cough. Raises nothing. Sleeps poorly. Lungs show good respiration. Good excursion. No râles.

July 24, 1915.—Weight: 170 lb. Feels much better. Says she has some pain in her chest, but says that her respiration is deeper than formerly. Lungs: Rare stretching sounds over lower half of back.

February 24, 1916.—Has done well all winter. Weight: 174 lb. Lungs: Show good excursion, good respiration. Scattered stretching sounds.

Case 9.—L. A., boy, aged 10. December, 1911.

F. H.—Father and mother alive and well. Mother has had two miscarriages. Father dissolute.

P. H.—Age of 6 months was dropped. At age of 10 months developed abscess of the right hip, resulting in ankylosis of hip-joint.

P. I.—Very weak. Cough and expectoration. Discharging ear. Inflammation of the eyes. Poor appetite.

P. E.—Has marked Hutchinsonian teeth, as have one brother and one sister. P. D., emaciated, very pale. Marked glandular enlargement. Lungs: Marked dulness. Râles and poor respiration. Weight: 46½ lb. stripped.

June 12, 1913.—For a year and a half has had careful anti-tuberculosis treatment. In that time he has gained 11 lb. Physical signs have improved decidedly. Mixed treatment started on this date.

December 19, 1914.—This last year and a half the patient

has gained 15 lb. The improvement has been very marked. Much less lung involvement. Sputum: Repeated examinations of sputum have failed to find tubercle bacilli.

Case 10.—C. B., little girl, aged 11. February, 1913.

F. H.—Mother a drinking woman, who was deserted by a drinking husband. Adopted at age of 6 months.

P. H.—Constantly ill. Frequent colds. Digestive upsets. Never able to go to school. Eczema of nostrils, corners of mouth, and back of ears.

P.I.—Referred to me after one and a half years of treatment for tuberculosis in a public institution.

P. E.—Showed extensive involvement of the lungs and a poorly developed and emaciated child. A careful record of temperature showed daily temperatures of from 100° to 101·5° F. for a period of four months. Weight: 65½ lb.

January 8, 1914.—After eleven months' rigid anti-tuberculosis treatment, this child was still very weak, showed marked trouble of the lungs, and weighed only 65¼ lb. Mixed treatment started on this date.

January 7, 1916.—Marked and rapid improvement during entire year. In October the child was able to go to school for the first time in her life, and has missed only two days of school. Lungs: Showed marked improvement. Weight: 78½ lb., a gain of 13¼ lb. Sputum: Repeated examinations of sputum have failed to find tubercle bacilli.

Case 11.—G. P., small boy, aged 9. December 9, 1909.

F. H.—One uncle and one brother epilepsy.

P. E.—Marked Hutchinsonian teeth. Marked lung involvement.

June 19, 1913.—After three and a half years' treatment this boy gained 3½ lb. Condition of lungs has shown no improvement during the past year. Mixed treatment started on this date.

October 4, 1915.—Two and a third years later this boy had gained 25 lb. The improvement of the lungs has been as marked as his improvement in general condition. No tubercle bacilli have ever been found in his sputum.

No Wassermann tests or X-ray examinations have ever been made on these last three cases.

Discussion of Findings.

There is strong evidence of syphilis in these individuals; previous history of sickly children, born into families where there has been a series of miscarriages, dead-born children, and early infant deaths; subsequent history of chancre, or loss at an early age of their own children; physical signs of general glandular enlargement, Hutchinsonian or badly decayed teeth, scars, and skin eruptions; positive Wassermann tests; radiographic findings very positive in three cases, suggestive in three others of syphilitic bone lesion and circulatory lesions.

There is equally strong evidence of disease of the lung; marked dulness throughout both chests; poor respiration; limited excursion; varying numbers of moist and dry râles confined more to the bases than the apices of the lungs; history of cough and expectoration.

The following evidences of disease were found by the radiographs; periostitis of the tibiæ, fibulæ, clavicles, and ribs; marked broadening of the arch of the aorta; enlarged heart; in two cases infiltration of the lung tissue; plueritic thickening. Definite involvement of bones, aorta, and lungs was found in three cases; suggestive involvement of the bones was found in three others, one of the latter showing an enlarged heart and broadened aorta, another an enlarged heart, and another pleuritic thickening.

These cases have been under treatment about one year. They have observed simple hygienic rules, such as early hours, good food, three meals a day, reinforced by two luncheons. In addition, they have had tr. nux and gentian before meals and mixed treatment after meals. One had injections of mercury for five months. All but one have worked steadily.

The results of treatment have been small gains in weight, 3 lb. to 16 lb., great improvement in general physical condition, marked diminution of tendency to take cold, and improvement in chest findings, such as disappearance of râles, deeper and steadier respiration, and diminishing of dulness.

In the one case in which tubercle bacilli were found, no tubercle bacilli could be found subsequent to six weeks of mixed treatment. When this individual stopped mixed treatment he gradually lost ground, which was regained at once upon the resumption of mixed treatment.

Of the three children, one gained in the first one and a half years of treatment 11 lb.; then the only change in treatment was the addition of mercury potassium iodine. In the next one and a half years he gained 15 lb., and the lungs showed a corresponding improvement. Another lost after one year of treatment $\frac{1}{4}$ lb.; then mercury and potassium iodine were started. At the end of nine months she had improved so much that she was able to go to school for the first time in her life, and when the year was completed she had gained 13 lb. in weight. The third was under treatment for three and a half years before mercury was given. During that period he gained slowly, the lung condition cleared up very slowly, and his weight increased only 20 lb. After the mercury was started in one and a quarter year less time he gained $4\frac{1}{2}$ lb. more, or $24\frac{1}{2}$ lb. His lungs, which had shown no improvement for a year, showed marked diminution in dulness, marked increase in respiratory excursion, and all râles disappeared. In addition to these marked gains in weight, these children have grown from 3 in. to 5 in. taller since the mercury was started.

Evidence, if any, of syphilis of the lungs. We must first establish the fact that there has been disease of the lung in

these cases. This is proved by the respiratory symptoms, such as cough and expectoration, tendency towards frequent colds, poorly developed chests, poor expansion, marked dulness, and râles varying from few to some, and from dry to moist. The radiographs show infiltration in two of the lungs, and pleuritic thickening in another.

These conditions occurred in individuals where the only signs pointing toward tuberculosis were the physical findings of the chest examination. Family exposure to tuberculosis is lacking, no tubercle bacilli were found in the sputum, and von Pirquet tests were negative.

On the other hand, there is good evidence to point to syphilis in other parts of the bodies—at least, of these people. The family and personal history conforms to that diagnosis; the physical examination is in favour of it; the Wassermann test is positive in contrast to a negative von Pirquet. In three cases the long bones show definite syphilitic lesions, and in three others suggestive lesions.

Finally, the evidence of treatment favours the diagnosis of syphilis. These patients were allowed to work; they did not attempt to live or sleep out of doors, but were given instead tonic treatment, together with anti-syphilitic treatment. That they made definite improvement is very certain; that they retrograded when they stopped treatment is equally certain. In the cases of the three children, the improvement in condition, after long and most careful anti-tuberculosis treatment, was most marked, and can scarcely be called a coincident, or one that was bound to follow because the tuberculosis was being cured. This improvement was much the longest delayed in that case from which the mercurial treatment was withheld the longest.

This improvement under mixed treatment has not taken place solely in the general condition. The local condition

of the lungs has improved. Shortness of breath has diminished, asthmatic attacks have disappeared, tendency to take cold has ceased, respiration has become deeper, clearer, râles have dried up, and, finally, the amount of dulness has lessened.

Conclusions.

We have, therefore, cases showing definite lung lesions in persons who lack two definite laboratory signs of tuberculosis, positive sputum, and von Pirquet tests, and who give no history of contact with tuberculosis. These persons, on the other hand, react positively to the Wassermann test, have definite family history of syphilis, show syphilitic lesions elsewhere in the body, and respond rapidly to syphilitic treatment. Most important, the local condition of the lungs improves as definitely under syphilitic treatment as does the general condition.

To me, however, the evidence which I have tried to secure is far from conclusive. Too often tubercle bacilli cannot be demonstrated in the sputum of patients who have later been proved to have tuberculosis. The number of cases which I could collect have been too few, the difficulties of controlling them too great, and the lack of radiographic confirmation of demonstrable lesions in the lungs themselves leaves us with the result of treatment as the strongest link in our chain. This is far too weak a link to overthrow the strong evidence of the pathologist that syphilis of the lungs is very rare.

I realize fully that if there is such a thing as syphilis of the lungs it must be demonstrated on the autopsy table. If, however, the facts of medical treatment and clinical observation continue to point toward such an infection of the lungs, as I believe they will, greater efforts must be made to find pathological corroboration.

DISCUSSION.

Dr. ROCHESTER: I have been much interested in this presentation, because I have had quite a unique experience in an institution where they are taking cases of chronic tuberculosis. Where we find the mixed infections present, shown by the Wassermann test and tubercle bacilli in the sputum, these cases improve very materially under antisyphilitic treatment, and not well under the ordinary tuberculosis treatment. I think it was Dieulafoie who originally made the statement that when a case showed the ordinary signs and symptoms of pulmonary tuberculosis, but with the persistent absence of tubercle bacilli from the sputum, you must suspect syphilis. And in all instances where such cases have come under my observation I have immediately instituted tests for syphilis—by the X-ray and by the Wassermann reaction, and I have been surprised by the number of cases in which these tests have proved positive. I have statistics of the results under mercurial treatment in such cases; they are excellent.

Dr. BROWN: Personally I do not believe it is worth arguing that because a case does better on treatment with mercury the patient has syphilis. The rate of improvement of many cases of lung tuberculosis coming for the first time under good care is so exceedingly rapid that I think we had better stop connecting these cases with syphilis just because they may be taking mercury at the time. In my own experience I have rarely been sure that the case was syphilis. In one case, which was the most astonishing I ever observed, I had supposed we were dealing with a unilateral pleuritis. On the X-ray plate there was an absolutely even dense shadow on the whole left side, without differentiation of heart outline, lung markings, and only in a few places of ribs. There was no variation in the density, and so dense was the entire shadow that the outline of the heart on the left side was entirely obliterated. Now had there been a pleurisy in that case primarily, the heart would probably have been pulled permanently out of position. In pleuritis, with subsequent contractions, you will always get a contraction of the sixth, seventh, and eighth ribs on that side, and the heart drawn over and the diaphragm raised. There is also frequent compensatory spinal curvature. In this case we could not tell whether the heart was changed—it certainly did not extend beyond the right border. I have been looking for syphilis of the lung for ten years in two large hospital services and have examined in the neighbourhood of 4,000 X-ray plates, and in only this one case was I entirely satisfied that there was syphilis of the lung. This case had a four plus Wassermann

A CASE OF SPONTANEOUS PNEUMOTHORAX WITHOUT SYMPTOMS. PLATES AT ONSET AND FOUR WEEKS LATER.

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At the meeting of our Association at Atlantic City in 1914, Dr. Louis Hamman presented a most interesting paper on "Spontaneous Pneumothorax," in which he gave the clinical histories of four cases of this condition which had come under his observation. Dr. Hamman's paper covered so thoroughly the literature on this subject, and reviewed so fully the theories as to its etiology, that there is no need of my taking up space in our TRANSACTIONS by a general discussion of this interesting phenomenon. A case similar to those reported by him recently came under my observation, and as I was so fortunate as to secure plates of the chest at the time the patient consulted me, and again four weeks later, I felt that the presentation of the history, accompanied by the plates, might be of interest.

Early in last December one of the New Haven physicians telephoned me and asked if I could see a case that afternoon if he sent him around to my office. He said that he had seen the patient three years before, when he came complaining of a peculiar pain in the right side. At his examination

at that time he had found an apparent absence of breath sounds on the right side, the thorax being otherwise apparently normal. The patient complained of no other symptom but the slight pain, and did not return for re-examination, as requested, until a couple of weeks later, when the chest was apparently normal. Being somewhat deaf, he (the physician) had thought the former apparent abnormality in the right side might have been due to his own deficient hearing, and had thought no more of the case until the man had again presented himself that day, complaining of the same symptom and showing the same physical signs as three years before.

The patient arrived at my office shortly after, having walked up from his place of business a few blocks away. He was a man of 30, of spare build, but up to his usual weight. He complained of a slight but persistent pain which had been present for two or three days, and which he described as of a peculiar, dragging character extending from the lower margin of the right axilla upward and inward toward the mid-sternum. On the two previous evenings just before retiring he had felt a slight feeling of oppression and suffocation just back of the sternum, and had consulted his physician because of this.

His family history on both sides was free from any suggestion of tuberculosis, asthma, or chronic cough.

The patient had never been ill in his life, and had been remarkably free from colds. He had when in college been a member of the gymnasium team, and his wind had always been excellent, except on the occasion when he had been seen three years before. Then, as at present, he was a trifle short of breath, but not enough to worry him. He had never had a cough, his strength and appetite were good, and he had been steadily at work at his business of merchant.

Spontaneous pneumothorax—at onset.

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His temperature at 3.30 p.m. was 98·4° F., his pulse was 80 and of good character. Aside from the slight annoying pain above referred to he considered himself in normal health.

Upon examination I was astonished to find an apparent complete pneumothorax of the right side, with complete loss of breath sounds, hyper-resonance, and typical coin sound. The heart was only slightly displaced to the left, and the left lung was apparently normal. My suggestion that he go home and to bed was met with astonishment and scorn. It appeared that he had arranged to take his wife to New York that evening for a week of theatres and sight-seeing, and he saw no reason why the programme should be altered. I secured his consent to an X-ray of his chest, and had it taken and developed immediately. With the aid of the plate I succeeded in convincing him that something was the matter with him, and sent him home to rest in bed under his physician's care. I did not see him again until exactly four weeks later, when he again came to my office looking and feeling perfectly well. He had remained in bed two weeks, and had been back at his place of business for the past week. Examination of the chest showed the pneumothorax had apparently disappeared save for a slight hyper-resonance over the base of the right axilla. The breath sounds were, however, markedly impaired above the second interspace on the right, and there were moderate moist râles over this area after cough. There were also very distinct râles on the end of deep inspiration over the extreme base in front. I made a diagnosis of apparent latent tuberculosis, and advised his stopping work and putting himself under proper and constant supervision in order to learn all he could about tuberculosis while building up his general health. He followed this advice, and is now about to return

to work in excellent condition, and having had no symptoms whatever since I saw him.

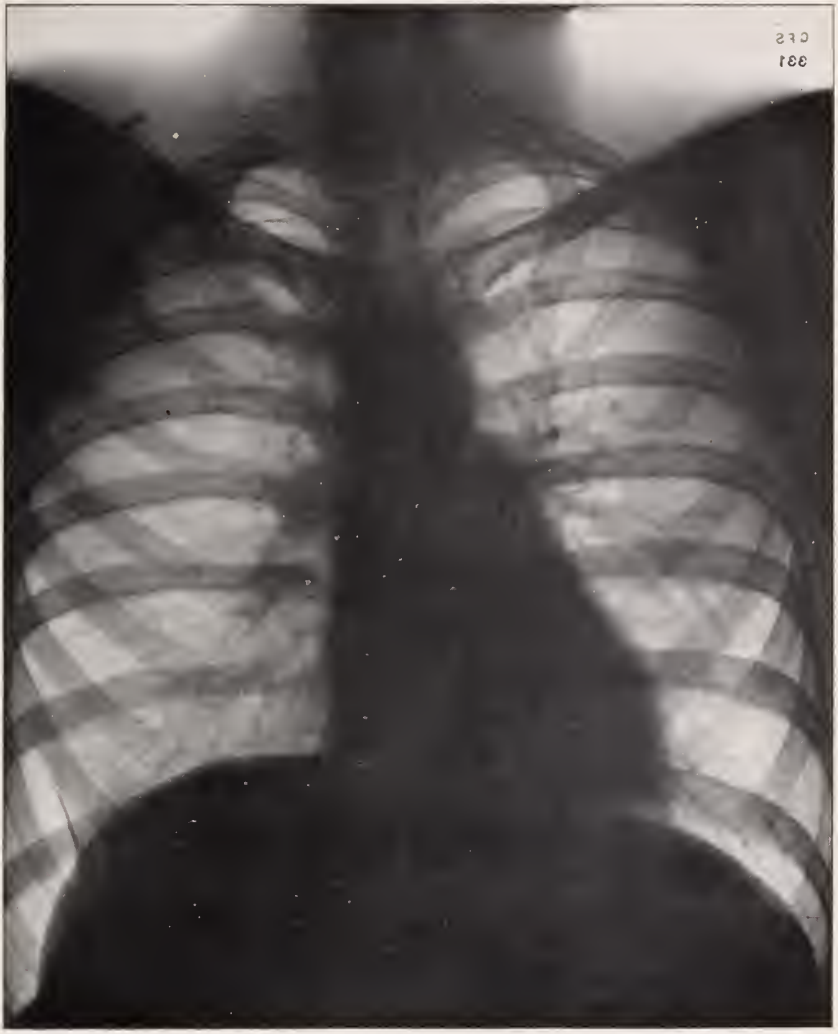
I was able to secure a second X-ray of his chest on his second visit, and the plates which I am submitting to you show, first, the very marked pneumothorax which was present when I first saw him, and, second, the almost complete re-expansion of the lung exactly four weeks later.

The especial points of interest in the case are the almost total absence of symptoms with the complete compression of one lung; the strong probability from his history and from the notes of his physician of his having had the same condition on the same side three years previously; and the evidence of subsequent physical examination and of the second X-ray that the condition had probably been due to a latent, unsuspected tuberculosis, though the patient had a clear family history, and no history whatever of any previous illness or suspicious symptoms.

DISCUSSION.

Dr. ELLIOTT: We have had several cases of definite spontaneous pneumothorax, but those without symptoms I think are comparatively rare. The only one I have seen occurred last winter, and whether this case was spontaneous or not it is difficult to say. The physicians at the hospital reported a patient on the medical side who had been admitted the night before. I saw her on the following day, and found that she had a complete pneumothorax of the left side. Some 46 oz. of fluid had been aspirated the evening before. She felt no discomfort whatever; there was no dyspnœa and no elevation of temperature. But there was a slight percussion splash, showing all of the fluid had not been removed. She had at no time any dy-pnœa. She remained in bed for about three weeks. At the end of that time a small gas bubble was shown in the lower axillary region by the X-ray plates, and at the end of four weeks this had cleared up. It is interesting that the pneumothorax had been entirely overcome in the course of four weeks and at no time gave any symptoms.

Dr. MINOR: I have had the privilege of seeing and watching the case Dr. Lyman has described. I would only say that at the time he



Same—four weeks later.

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was sent to me the X-ray no longer showed the existence of the pneumothorax, and that there were only slight signs of an inactive tuberculosis, and that the patient after a course of treatment reached the point where he was able to exercise freely, to play golf, and remained afebrile, and went home in excellent condition. This winter I have had a similar case of spontaneous pneumothorax, only in this case there was no trace of tuberculosis to be found. The patient was a young business man of Baltimore, who, though he had had no symptoms, one day in the street felt a little faint, though he had at that time none of the acute pain and shock so often seen. He paid no attention to this, but finally began to develop some pain and shortness of breath, so that he consulted a physician. Pneumothorax in this case was of slight degree, was rapidly absorbed, and his lungs now present a perfectly normal finding.

Dr. DUNN: I have had some doubt as to the frequency of this condition, because in the examination of a large number of cases we have encountered it but rarely. In this series of 1,000 cases, as I have said, it occurred rarely; but almost immediately afterwards we began to have a series of cases showing spontaneous pneumothorax. It seems to me that its occurrence comes in waves. I believe that a complete pneumothorax is very seldom overlooked. I have, however, recently had a case in which the upper lobe of the lung on either side was completely collapsed, and there was nothing in the history of this case in the physical examination to indicate the occurrence of a pneumothorax.

Dr. PARFITT: I had an instructive case of recurrent spontaneous pneumothorax a few years ago. The patient had had tuberculosis for six years and had gone to Arizona. While there, in May, 1913, he had severe pulmonary hæmorrhage. He recovered from this, and early in July had an attack of severe dyspnœa, which distressed him for some days. In September he returned to Gravenhurst. The pulmonary conditions were more advanced than when he left some two years previously, the heart was in approximately normal position, and the lower part of the left lung was the mainstay of respiration and appeared to be emphysematous. During two months he had slight recurrent dyspnœa, but I did not see him during an attack. One afternoon he suffered with severe dyspnœa and a spontaneous pneumothorax of valvular type of the left side was obvious. A needle in the chest was connected by tubing to a bottle of water. Excessive pressure was relieved through the water valve and he lived for about a week. I had apparently overlooked a recurrent pneumothorax. At several examinations the physical signs at the left base could readily be accounted for by emphysema.

Dr. W. H. SWAN (Colorado Springs): I think that spontaneous pneumothorax occurs much more frequently than we have any realization of. I saw, a year or two ago, a Japanese house-servant who had

no dyspnœa and no particular symptoms, and who had been sent to a doctor to make sure there was nothing wrong. This physician had made a diagnosis and had had an X-ray taken, which demonstrated a complete collapse of one lung. As far as I know this man never had any symptoms. I have had another patient, a farmer, who had been sent to Colorado because of tuberculosis. He was under no physician's care. Following an afternoon's bowling he felt ill, but without any pain or dyspnœa. He had gone to bed because he felt sick. I saw him three or four days afterwards, when he had high temperature and an easily demonstrable pneumothorax, with fluid, later found to be pus. Here were two cases within a very short time. I believe that pneumothorax, of greater or less extent, does occur very much more frequently than we have any idea of.

THE PROBLEM OF REST OR EXERCISE IN THE TREATMENT OF PULMONARY TUBERCULOSIS; A PLEA FOR LESS ERGOPHOBIA.

By CHARLES L. MINOR.

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In the treatment of pulmonary tuberculosis there are no more important measures than rest and exercise. On their wise and judicious use rests a large part of the success of our therapeutic measures. In the past a vast number of consumptives have come to their end directly through an injudicious use of exercise, and the advice, "Get a horse and ride out West," so frequently given thirty years ago was undoubtedly of more benefit to the undertaker than to the patient. Reacting from this rash and foolish use of excessive exercise our profession have learned the priceless lesson that in the beginning of the treatment of tuberculosis rest is always indicated, and the reclining chair, the cot, and the shack have replaced the mountain climb and the horseback ride with the happiest effect. Twenty years ago many patients came to me suffering from the effects of excessive exercise. I recall two slender young Irish girls from a large Massachusetts town who called me in when one had fainted as the result of a five-mile walk. They were advanced cases of active tuberculosis with excavation, yet the only advice their home doctor had given them was to

avoid doctors, to eat freely, and to walk as many miles daily as they could. This advice they had proceeded to carry out with afternoon temperatures of 103° F. and over, and with the result noted. By absolute bed rest their fever was brought down, their symptoms greatly ameliorated, and the activity in their lungs decreased, and while one was past any cure, the other lived for many years a happy if semi-invalid life. Probably any of my auditors could duplicate such a history, and even among general practitioners to-day there are few to be found who would give such advice. The profession have at last painfully learned that rest is good in the treatment of tuberculosis, and patients get much more careful attention on this score than formerly. But doctors, like all other men, are prone to run to extremes, and, while I realize how heretical it may seem to say so, I believe that to-day many of us are tending to push rest to an unwise extent. I see patients so indoctrinated with the idea of the necessity of rest that when they are discharged they are afraid to move, and they live a useless life recumbent on the sofa, refusing to exert themselves in any way, and for all the good they are to themselves or the community they might as well have died rather than recovered, if such a life can be called recovery. Patients with normal temperature are kept flat on their backs, laying up useless pounds of fat rather than turning that fat to muscle by judicious graduated exercises. Weight as weight, and not as representing vitality and working efficiency, is looked on as the *summum bonum* and good in itself, and such patients are only fit for the eternal quiet and contemplation of a Thibetan monastery.

If I were talking to a body of general practitioners I would not speak in this way, for they might misunderstand it, and it is far safer to overdo rest than to return to the former overdoing of exercise. But before a body of clinicians like

this, who are alive to the latest and best in the advance of medicine, I can speak freely and not be misunderstood, and for such I believe it is wise to stop a moment and consider in how far rest and how far exercise are desirable in the treatment of pulmonary tuberculosis.

It is needless in studying this question to go back to the history of medicine to show how intelligent were the views of Hippocrates and Celsus, or to review the dispute between Brehmer with his theory of the small heart in tuberculosis and the consequent need of active exercise, and the wiser view of his pupil Detweiler, who, seeing the bad effects of over-exercise, advocated recumbent rest. We need only go back to the time when our great American leader in Phthiseotherapy, Dr. Trudeau, as he has so graphically told in his autobiography, went in the "seventies" to the Adirondacks for his health, and, as we can now realize, wasted much of his superb vitality and his opportunity of permanent cure in over-exercise. By degrees, by the experience of his own case and by that with many patients, he was brought to use the rest he had so neglected, and among his followers, not merely in Saranac, but all over our land (for he was verily the medical father of all American phthiseotherepeutists, whether they had worked under him or not), we find a realization of the value of rest, a healthy fear of the danger of exercise, which in that day was most certainly justified.

The Adirondack recliner soon dominated the hygienic management of the disease, and many were saved who, had they exercised, would have been lost.

What was the reason for the success of rest? First, it lessens circulation, and hence toxic absorption; second, it lessens oxidation and lowers temperature, and so decreases tissue waste; third, it puts the diseased lung at rest; fourth, it rests the heart; fifth, it lessens cough and expectoration,

probably because quiet decreases physical and pathological activity in the diseased foci; sixth, it encourages weight-gaining; seventh, if properly managed it helps to put the mind at rest.

Now all these things are admirable and, in certain stages of the treatment essential, but there comes a time when disadvantages show themselves, and when too long continued rest ceases to be of value and becomes harmful.

When the temperature falls, when the afternoon figure is not over 99·4° F., when the pulse slows, showing a decrease of toxin absorption, when strength is improving, when the trouble is less active and we desire to develop the compensating function of the healthy part of the lung by the quiet deep breathing which walking causes, when cough and expectoration are much reduced and we can therefore assume there is less ulceration and activity in the diseased area, when the patient needs the stimulus of hope and the encouragement of a positive proof of his improvement, when his gain of weight is marked and without exercise is apt to produce fat rather than muscle, then I believe we should take up exercise not merely on the theory of Pattison, in which I concur in order that the patient may undergo an autotuberculin treatment only, but to prepare him when he shall be restored to resume his life in a normal way, and not to be turned, as too many are, into pulmonary hypochondriacs. Because it has been abused many men are afraid to mention the word exercise, just as bleeding was unjustly discredited from its one-time abuse; but exercise is just as essential in phthiseotherapy as is rest, and should be dominant in the latter months of any successful cure. Beginning with from one to five minutes, according to the case, and increased by from one to five minutes a day, and guarded by a carefully kept record of symptoms, fever, and

pulse, kept by the patient, and which the doctor should see twice a week, and topped or decreased just as we would tuberculin, if a reaction occurred it need subject the patient to no risk. It should be worked up very gradually through the course of weeks and months to as much of three hours on a stretch of walking or eighteen holes of golf. This brings the patient to the end of his cure fit and strong rather than fat, with a weight not over or even slightly under his insurance standard, full of healthy vigour, not afraid of himself, knowing how much he can do and what he cannot do, and ready to resume his work with a chastened knowledge of his former hygienic sins, and a confidence that in the future he will know how to combine health with work.

And how shall we safely gauge the use of rest and exercise?

(1) It is essential that the doctor keep a close tab on his patient's life, at first bi-weekly, then weekly, and never less than once in two weeks, so as to detect and remove over-exertions. Of our guides temperature is the first and best. Every patient, whether febrile or not, should, when first beginning treatment, go through a period of absolute rest, not merely for its therapeutic effect, but that we may become familiar with his normal run of temperature. If we find after a few days a normal temperature, and if the other data are favourable, we can allow him up, and give him increasing graduated walks, to be measured carefully by the watch. If the temperature in the afternoon is as high as 99·4° F. he can be got up at first in the morning only, then in the afternoon as well, and finally all day, the graduated walks coming a little later when he has proved that his trouble is inactive enough to show a fever rise after talking, reading, or visitors. If it is 99·6° to 100° F. bed rest, while not absolutely essential, is best till it keeps the temperature

down, as it usually does; but if the patient is of a restless, fretful, high-strung temperament, it is often wise to allow an hour or so in the morning in a reclining chair. If the temperature is 100·6° F. or over absolute bed rest is necessary, though I cannot agree with those extremists who insist on the use of the bed pan and the urinal and absolute recumbency without motion, for I think for psychological reasons this is undesirable. In cases where persistent bed rest fails to reduce temperature, and yet where the general condition is fair or good, I at times experiment with getting the patient up, and occasionally find that the temperature will thereupon disappear. It is scarcely necessary to note that the doctor must be sure that the patient is not running a concealed night temperature. During bed rest it is most important to keep the patient heartened up and to teach him mental relaxation and resignation, for many patients who are at physical rest in bed are in a constant mental turmoil and kicking against the pricks, which is as bad or worse for them than physical exertion.

Pulse.

Unduly rapid pulse (100 or over) is a good indication for rest, but when on experiment we find that moderate exercise causes no rise it need not be an absolute indication for rest, but only for the reclining chair. Further, some people run constitutionally fast pulses, and if we can be sure of this it can be discounted.

Cough and Expectoration.

Abundant cough and expectoration is made worse by talking, laughing, and walking, but such cases are apt also to be febrile, so we do not need this as a guide. Blood-streaked or pink expectoration is an absolute contra-

indication; but I have seen patients in whom such blood-streaking was apparently a permanent habit, even when they were febrile and doing well, and after long tests I have with great benefit allowed walking in such cases.

Weight.

Any patient who is losing weight, save unduly fat ones, where we wish to allow a slow and cautious reduction, must be at chair rest or at times bed rest. A poor weight, however, is not necessarily a contraindication in a patient who is normally spare, but is wiry. In considering weight, I find it of great value to record not merely the patient's average weight, his average best weight, and his absolute best, but his insurance standard as gotten from the tables, and I like to keep the latter before me as my ideal for him, and I consider it unfortunate for him to surpass that ideal very much, a really fat patient not being a good result for our treatment.

Fatigue is one of our best guides. A little healthy tire passing off rapidly has no significance; but to get really tired or fagged is bad, whatever the temperature or pulse may be. However, if the patient's exercise is increased by a little each day this can be entirely avoided, save as an indication of an intercurrent congestion.

Mental Attitude.

A patient who has been treated by prolonged bed rest is usually very much afraid of any exercise, and has to be brought to it very gradually, for to make him do what he considers dangerous is unwise; but since the proof of the pudding is in the eating he will soon be converted, if he finds the one, two, or three minutes have no bad effects.

Of course, mental rest is much more difficult to obtain than physical. A patient may be lying quiet in bed and yet, unknown to us, may be worrying or suffering and fearing terrible things. This is difficult to find out. Yet, if we are to help our patients it is up to us to discover it, and it is at this point that the phthiseotherapeutist must take on the character of the kind and sympathetic but firm father confessor, in order that the patient may practise with him that mental catharsis which alone can put his mind at rest. Indeed, so essential is mental rest that we should never be satisfied until we have secured it for our patient.

Methods of Exercise.

In the bed patient it may, though very seldom, be necessary to give artificial exercise in the form of abdominal or limb massage (never chest) to keep his digestion going and to burn up waste products. The first step toward exercise is in sitting in a reclining chair for half an hour, the time to be lengthened each day, two-thirds of it spent recumbent, one-third erect, and for this a proper chair, which will lie back flat or come straight up by the motion of the patient's body, is essential, and such chair must have an absolutely flat back to encourage erect shoulders, which I believe to be most important for the tuberculous patient. For the patient who has to be constantly supine there is nothing better than the Adirondack recliner; but when he reaches the stages of sitting up he cannot let down his legs, and its adjustment not being automatic it discourages frequent change of position, which is important to prevent tiring of a single set of muscles and to prevent fatigue or monotony. The next step in exercise is crocheting for women, solitaire for the men, and reading for both of them, and any of these can raise temperature if overdone. Next

comes walking, according to the rules already noted. To my mind no other exercise can compare with it, and it can be perfectly graduated from the very shortest quiet stroll to a brisk morning's walk up hill and down dale as indicated. Driving is not as passive and easy for patients as short walks, and no one drives for less than fifteen minutes or half an hour. The temptation to overdo is much greater, and the patient does not have the natural warning of his overdoing. Autos are easier than carriages, but I allow neither one nor the other until the patient can walk from one-half to an hour without bad effect. When a patient has been afebrile for a long time, when the process is inactive, with no moisture and little or no expectoration, I allow, in selected cases, short rides on a racking or pacing, but never a trotting horse. This is especially good for dyspeptics, and could be worked up by degrees from one to three hours. To those of limited means, trolley riding is enjoyable, and it can be allowed sooner than carriage driving if the trolley is near the house. After the patient can walk easily for an hour on the level, I have him begin the ascent of increasingly steep hills until the rather steep hills in Asheville can be easily taken, and I am never fully satisfied with the patient on discharge if he is unable to walk three hours over our hills with no undue dyspnœa, with no loss of weight, no fatigue or tachycardia. This is the nearest I can come to a test of his ability to stand the tax of his work, and shows me that his physical force is re-established, and that he should have such vitality as to enable him to complete the fibrosis of his case and to resume a normal life. What a difference between such a patient, rosy, strong, with firm muscles and bright eyes, with full knowledge of the possible dangers of relapse, yet also with the knowledge of how to prevent it, and, on the other hand, the fat, puffy, timid one just up from his couch,

afraid to make any exertion, and prizing each pudgy pound of fat that, if he but knew it, represents a burden rather than an asset.

After all, we are not trying merely to save our patients' lives, but to return them to normal useful activity, so strengthened that they can reasonably be expected to stand a strain, and so instructed that they will take the happy mean between a timid anxiety lest they relapse, and that foolhardy overdoing and return to old indiscretions, which is so sure to land them in trouble.

Aside from the physical advantages of handling our cases with a less unreasonable fear of exercise are the manifest psychic advantages; it breeds courage instead of timidity, hope instead of fear, and thus it makes the mental attitude so much more favourable for getting a good result. We doctors are too apt to treat our patients' bodies and not their minds, but every patient that leaves the cure must not only be physically rebuilt, he needs with rare exceptions to be mentally rebuilt to be a better man with more will-power, with more knowledge, with more determination, with more self-mastery than he had before, and in the mental education which leads to this, I believe a less timid use of exercise can play a large part.

DISCUSSION.

Dr. BONNEY: I am very sorry that I did not hear all of Dr. Minor's paper, although I heard enough to give me an idea as to its excellence; and I wish to go on record as being essentially in accord with all that he said. I should like to amplify or supplement, if I can, in a very few words, one point that I imagine he will agree with. It is very difficult, I think, to formulate any general or routine plan that will be properly applicable to all cases and all places. The method that Dr. Minor would employ in Asheville is not necessarily the method that would be properly applicable in Colorado, and the method that he would think eminently wise for one patient is not

necessarily strictly appropriate for all. I feel that every case should be judged on its own merits; and it is the judgment, the discretion, and the resourcefulness of the physician which must decide just how much exercise the individual patient should have. It may not be estimated purely on the extent of lung involvement or on the pulse, but all factors should be given very serious consideration—the digestion, the nervous system, sleep, and the tendency to fever. I am in hearty accord also with Dr. Minor's views about the injurious effect of injudicious overfeeding; and I feel that one reason why we should be cautious in this respect is because of the extra burden put upon the kidneys by an excessive protein diet. The kidneys are perhaps already overtaxed by their efforts to eliminate the toxines incident to the tuberculosis infection, and perhaps in many cases to a streptococcus infection as well; and when we add what is commonly regarded as an important feature of treatment—namely, an excessive protein diet—we are simply adding to this eliminative burden imposed upon the kidneys. I have wished to call attention to the necessity for a very wise and cautious discrimination in our efforts to decide just to what extent the individual patient should be permitted to exercise and to overeat. I want to call attention to one other consideration. Our primary obligation, it seems to me, is to bring about an arrest of the tuberculous process. The future of the patient is going to depend upon whether he can now be restored to his former usefulness and activity. The primary obligation is that the infection should be arrested, and if possible cured. We can decide what to do to promote the patient's future efficiency after this preliminary arrest has been accomplished. It is not for us to say what his ultimate future is to be, how much adipose tissue he is to have, or how much energy he will have. The fact of immediate importance is that he is confronted with an infection which is a *menace,* and our primary obligation is to lose no possible opportunity to promote his early recovery, and later to take into consideration other factors of importance.

Dr. Will Howard Swan (Colorado Springs): I want to emphasize the point that both Dr. Minor and Dr. Bonney have mentioned—that it is the individual need, the individual problem we must consider. In other words, we must consider that we are dealing with a patient who has tuberculosis rather than with the disease itself. I think that is a possible disadvantage of an institution, and it is up to us to find out what the individual conditions are and to deal with them wisely. And I believe our success with these patients will depend on our getting close to them—not simply knowing their physical condition—but on looking first into their lives and environment, and then considering their disease.

Dr. Pratt: Dr. Minor has given us many impressions, but no facts. We could go on talking about this problem of the relative value of rest and exercise in the treatment of phthisis at these annual meetings

for fifty years, and if we continued to present only impressions of our personal experiences we would probably hold the same opposing opinions at the end of that period, if we lived that long, that we do to-day. Dr. Minor would still advocate exercise and I rest. You will recall that when the great Louis at the close of his investigations submitted his carefully recorded facts to the test of arithmetical analysis he found that in every instance the impressions he had formed from the recollection of his own observations were wrong. Now in deciding this question of the curative value of rest or exercise in the treatment of tuberculosis we should adopt the scientific method. A few years ago I collected published statistics of various clinicians and compared the results of those who had employed rest with those who had used exercise. I beg to refer Dr. Minor to that paper.[1] There has never been a more ardent advocate of exercise than the distinguished Dr. H. Weber, of London. He gives figures in support of his plan of treatment, yet the recoveries obtained by those who employed rest were far more than those reported by Weber. During the past ten years I have been making and recording observations on this subject. During the first two or three years I followed the regular hygienic treatment with graduated exercise as advocated by Dr. Minor. Since that time, and especially during the past five years, I have used prolonged rest. In fact, I have not used graduated exercise until the activity of the disease was apparently arrested. There are only three possible answers to this question of rest or exercise: (1) Rest is of more value than exercise. (2) Exercise is of more value than rest. (3) Rest and exercise are of equal value; in other words, it makes little difference, rest being of more value in one case and exercise in another. My statistics dealing with the same class of cases treated by the same physician, under the same conditions, except that in one group graduated exercise was given and in the other group prolonged rest was employed, should show something of value. I have carefully recorded data of these observations, and I promised Dr. Minor that I would analyse them. I do not know what they will show. I have the data with me and will submit them to analysis and present the result to-morrow, with the report on the ten years' work of my tuberculosis class, at the meeting of the National Association for the Study and Prevention of Tuberculosis. Until I can verify my impressions with facts I will make no further statement.

Dr. INGALS: This most excellent paper is so complete that it is hardly a subject for discussion. I wish that it could be read by every physician in the country. The whole matter has been gone over very thoroughly, and I shall refer only to one point—and this is the danger of giving a patient the idea that he must avoid all forms of exercise

[1] *Journal of Outdoor Life*, September, 1912.

as he begins to improve. I think, with many others, that it would almost be better to allow these patients to die quietly than to keep them alive if they are to be of no use to themselves or anybody else.

Dr. WOOD: For ten years I have made observations upon the same class of people whom Dr. Pratt has. Although I have not my facts with me, I am sure that those facts would bear me out in the statement that such of my patients as were able to walk four hours a day, a distance of ten miles, before returning to their work, have been those who have continued to do well and have not relapsed; whereas those who could not be brought up to this standard, because the exigencies of their lives made it necessary for them to return to work sooner, have been those who have relapsed.

Dr. MINOR: I am glad to have heard from our scientific workers, but my friend Dr. Pratt forgets, I believe, that medicine is an art as well as a science. I realize fully how important are statistics of patients treated in this way and that, only from such statistics can we draw reliable conclusions. Working with dispensary and hospital cases, this can be done; but it is a very difficult thing to keep satisfactory statistics of ordinary private patients, and while I have very full records of my cases, I doubt if they are as full as would be demanded by Dr. Pratt. As to the question under discussion, it is not a question as to whether rest or exercise is best. The question is, when is exercise best and when is rest best? The man who treats his patients altogether with rest, or altogether with exercise, is unwise. In this, as in most matters, it is a question of the good judgment of the doctor, and judgment is, after all, the most important quality for our profession to have. In the regulation of this question of rest and exercise comes in the art of medicine, and much as we reverence and respect the science of medicine, it alone cannot solve the problem. The doctor is treating the mind as well as the body of the patient. In handling the patient it is not as though he were handling test tubes or chemicals, but a living human being, and as long as the material we deal with is living human beings, medicine will remain an art as well as a science. Dr. Weber, of London, had no idea of what proper exercise was. His idea of the proper amount of exercise in these days would be considered extreme over-exercise, and I would no more think of following his teaching than I would the extreme ideas of Dettweiler as to the question of rest. If any of us were to follow exclusively Brehmer's ideas as regards rest, or Weber's as regards exercise, we would get very bad results, but by a combination of both we get good results. We advance in our knowledge of medicine by degrees, and the study of the mistakes of both these men enables us to apply what is best in the teaching of each in our medical work. The great trouble with the profession is that where it finds a good thing, it applies it in all cases without discrimination, as though it were the only possible thing, hence it is overdone. At one time exercise was

supposed to be indispensable and we overdid it. To-day we have found that rest is good. Some think it indispensable and they overdo it. Whenever the profession gets hold of an idea they seem to be carried off their feet and to think it is the only idea, and I believe that at present we are tending to be carried away by worship of extreme rest for our patients. As Dr. Wood has said, these patients have got to go back to work, and they must be prepared to be physically fit for that work. Patients who have been through a rest cure only, without graduated exercise, come to me often, and I find them hipped about rest, afraid to budge, unable to move; they have become absolutely useless individuals with a dread of any exercise at all, and their future utility in their community is at an end. And it is seeing such cases as these that led me to write my paper. It is a great pity that those who practise more exclusively the science of medicine, and those who practise more the art of medicine, cannot get together and each learn from the other. The laboratory scientist is apt to get arrogant and intolerant. The bedside observer, unless he is very careful and tries to keep in touch with the laboratory, is apt to get slovenly in his work. But, after all, both are observing facts and, therefore, are scientists; and it is a pity that he who works in the laboratory should distinctly think that his branch of science was the better of the two. After all, the first primary duty of the doctor is to his patient; if the laboratory can bring him aid in benefiting that patient, as it does so often, it is of infinite benefit. If it takes an arrogant attitude it will only bring about a divorce between the laboratory and the bedside, a position greatly to be regretted.

IMPRESSIONS AS TO THE CLINICAL VALUE OF BACTERIAL VACCINES IN THE TREATMENT OF PULMONARY TUBERCULOSIS.

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Although having had opportunity to note the apparent effect of vaccine therapy, independently of tuberculin, in a large number of patients, I will submit merely a preliminary statement of general impressions derived from clinical observation.

Do bacterial vaccines exert an influence for good in pulmonary tuberculosis, and if so, under what conditions and with what restrictions?

Are they capable of doing harm, and if so, what precautions should be observed, and what are the special contraindications for their use?

My position, from the data thus far obtained, is to the effect that vaccine therapy should by no means be permitted as a routine measure in the treatment of tuberculosis; that it has a legitimate place as a tentative procedure in a class of cases subject to certain modifying limitations; that careful adjustment of dosage is vitally important; that the number of pulmonary invalids for whom vaccines are properly applicable is comparatively small; that the results obtained are very uncertain; that the proportion of those exhibiting improvement is disappointing; that the gain established in

a few is sometimes impressive; that vaccines not infrequently are shown to possess vast possibilities of injury; and, finally, that the attitude of the profession should be that of the utmost conservatism.

It may be added parenthetically that the above seems to be true, to a certain extent at least, of tuberculin therapy.

Apropos of these rather definite opinions, attention should be called to the not infrequent delusion as to the efficacy of this treatment, to the indiscriminate administration of vaccines for nearly all classes and conditions of pulmonary tuberculosis, and to the deplorable results occasionally noted from the abuse of an agent, which, intelligently employed, may become at times of genuine value.

A single case may serve as an illustration of the careless empiricism displayed in the use of bacterial vaccines.

A lady, aged 32, came under my observation in June, 1915, presenting the history of a tuberculous infection seven years ago, since which time she has visited various health resorts and sojourned in several sanatoria, submitting to tuberculin medication for prolonged periods with subsequent unfavourable results, as well as to the administration of bacterial vaccines. She came to Colorado two weeks after a rather large hæmorrhage, exhibiting loss of weight, very considerable temperature elevation, dyspnœa, occasional chills, and night sweats. There were physical evidences of active tuberculous involvement in the right lung from the apex to the third rib and to the lower edge of the shoulder-blade. There was also active involvement in the left lung. Tubercle bacilli were very numerous in the sputum, and for months the tendency had been that of a progressive decline. In the face of these clinical manifestations and physical signs she was being given at intervals of one to three days a stock vaccine containing six different micro-organisms.

There had been no culture taken of the sputum, and hence no information obtained as to the nature of the infection, yet she was provided with an elaborate outfit, and directed to have her physician or nurse administer the vaccine in accordance with instructions received.

As there was no clinical or bacteriologic basis affording the slightest justification for this treatment it was promptly suspended, and the patient committed to a systematic *régime* in accordance with conservative methods. In ninety days there took place a complete control of the fever and other evidences of marked clinical improvement, including a gain in weight of 15 lb., and a pronounced lessening in the activity of the tuberculous process.

The development of unfavourable symptoms following the use of bacterial vaccine should always demand its prompt discontinuance.

In this connection it is interesting to note a similar illustrative example of the misuse of tuberculin.

In May, 1915, a patient from one of the large eastern cities presented a letter of introduction from an active practitioner, who described the condition, reported the use of an autogenous vaccine, and directed that there be given at regular intervals $3\frac{1}{2}$ mg. of Koch's old tuberculin.

Examination of the chest disclosed the presence of an active and extensive tuberculous involvement in the left lung, moist râles being recognized from apex to base. The sputum was literally peppered with tubercle bacilli. It is almost unnecessary to state that the tuberculin was discontinued and the patient put in bed. The temperature has since been normal, he has gained 35 lb. in weight, the cough and expectoration have entirely disappeared, and physical examination reveals but an occasional semi-dry click just outside the left præcordial region.

Can anyone fail to recognize the relation of cause and effect in such instances as these?

It is possible that the popularity of bacterial vaccines as a conventional measure for pulmonary invalids has not been as frequently observed by other clinicians in health resorts. In this event my impression as to their widespread employment before resorting to climate change must be regarded as one of the anomalies of my experience. While the detrimental effects of injudicious specific medication are not always as conspicuous as in the cases above cited, evidences of their unfavourable influence are not wanting in my own cases, as shown by occasional chills, elevation of temperature, increase of cough, malaise, or varying degrees of prostration. While these disturbing manifestations may, of course, be attributed to improper dosage, and therefore are capable of later amelioration or suppression, such happy adjustment of size and frequency of injections is not always to be attained. In the absence of precise laboratory methods to control their use, the results of their administration, especially under present methods of preparation, inevitably become a matter of extreme uncertainty. As usually prepared, even by those well-equipped for this work, there is no positive assurance that the micro-organisms constituting the vaccine are identical with those chiefly responsible for the infection and its consequences upon the individual. Cultures taken upon successive days with equal care do not always furnish the same results. The use of vaccines representing the isolation and incorporation of several varieties of micro-organisms is necessarily subject to still greater hazards. Notwithstanding accurate standardization, the clinician in such instances possesses no means by which to adjust separately the dosage of the several component ingredients. While a degree of immunity may thus

be established for one infection, no corresponding influence is exerted upon the others. It is entirely possible that, owing to modifying influences pertaining to the host and to important changes in the invader's incident to environment and adaptation, certain constituents of the vaccine may later become not only useless, but actually harmful by prolonging the negative phase and lessening individual resistance.

It would appear that the use of several separate vaccines, each consisting of but one type of micro-organism, would only add to the confusion, because of the difficulty of such an interspersing of doses as to allow opportunity for clinical deductions.

In this connection the work with the complement fixation test is of interest and worthy of commendation. It is perfectly conceivable that in some instances the information obtained by this means may be of the utmost value. This has been well shown recently in two of my patients, who exhibited an obscure fever with other symptoms suggesting tuberculosis, causing their removal to Colorado. In both instances the infection was shown by the complement fixation test to be gonococcic in nature, and was favourably influenced by vaccine therapy. Some difficulties, however, are at present encountered in employing this test to ascertain the predominant secondary infection in pulmonary tuberculosis.

It perhaps should be recognized that embarrassment may result from the existence of inter-current complications as an influenza or other infection, perhaps of remote origin, which may yield a positive response upon exhibition of the complement fixation test, and yet be without especial significance as regards the lessened individual resistance occasioned by another secondary infection. Thus in some cases it may be impossible to conclude that a positive test from one

organism affords any direct information as to the infection from which the patient is actually suffering. Furthermore, even in the presence of a positive test, the lack of definite control renders it impossible to measure with any degree of accuracy the extent of the immunity established.

As illustrative of some of these considerations, the following case is of some interest :—

In March, 1913, a patient came to Colorado fifteen months after the development of initial pulmonary symptoms. There was great loss of weight, prostration, fever, dyspnœa, cough and expectoration, with well-defined physical signs in each lung, with especially active involvement of the left. As a result of rest in bed and other rational measures without recourse to specific medication, there resulted a gain in the course of eight or ten months of 36 lb., with corresponding change for the better in all the clinical manifestations, including the physical signs. The improvement finally ceased, and was followed by a stationary period for several months, at the end of which a vaccine was prepared in ampoules by Drs. Simon and Burdick, and appeared to be of very substantial benefit in diminishing the cough and expectoration and lessening the moisture in the left chest. The vaccine was exhausted at the end of about three months, and a culture taken at that time disclosed an entirely different type of infection. Another vaccine was prepared by Dr. Burdick, and although administered for two or three months in steadily *de*creasing doses, exerted, nevertheless, an apparent unfavourable influence, whereupon it was suspended. After a delay of several months without appreciable change in the general condition, culture of the sputum revealed a still different combination of infections, and a vaccine prepared by Dr. Waring seemed at first to have a beneficial effect, and later became apparently inert. It is possible that in such an instance the information to be obtained from the use of the complement fixation test might prove of definite value.

It is also suggested by this and other experiences that the effects produced by bacterial vaccines may be merely

relative and the improvement but transitory, even though for a time there be developed an apparent increase in the defensive resources. Desirable as it is to avoid the production of a reaction in such cases, an indication of tolerance is not necessarily an evidence of acquired immunity, and is quite insufficient to justify an assumption as to the benefits afforded. Similarly, the absence of unpleasant symptoms does not always suggest the wisdom of continued increase of dosage, but the nature of the clinical manifestations may represent important contraindications.

In this connection especial attention should be devoted to the condition of the kidneys. In many instances these organs are already overtaxed in the effort to eliminate toxins incident to the tuberculous and mixed infections, especially those of streptococcic origin. An additional burden is often imposed by an injudicious attempt to increase largely a proteid diet. Under a prolonged continuance of these conditions the administration of vaccines in large doses may be responsible for urinary findings indicative of further injury to the renal tissue.

Amidst the obscurity involving many features of vaccine therapy and the inherent difficulties owing to the possible complicating conditions in pulmonary tuberculosis, arbitrary conclusions seem unwarranted. Provisional opinions are permissible only when possibilities of error are eliminated to the fullest extent. When the employment of bacterial vaccines represents simply the introduction of a new element in the therapeutic *régime,* all other conditions remaining approximately the same as before its use, it may be fair to assume a causal relation. Thus sources of confusion and doubt as to the value of this or any other medicinal agent must obtain, if administered to invalids shortly after radical climatic change, the physiological influence of which may completely overshadow the effect of specific medication.

In like manner incorrect deductions are unavoidable in the event of a coincident change of management or mode of life. In order to minimize the uncertainties of clinical opinion as to their value, it is essential that vaccines be used only in carefully selected cases, preferably those conforming to a rigid *régime* for a considerable period without change of climate or environment. The conclusions thus afforded are made still more reliable if the application of this agent is limited to patients whose condition had become more or less stationary with the ultimate prognosis somewhat doubtful. In the absence of a definite progressive tendency in either direction the development of a substantial clinical change following its use cannot be entirely disregarded. There exists no valid excuse for giving vaccines to patients who are doing well, and but little encouragement for a proper interpretation of results if given to those who are rapidly declining. While vaccines would seem especially appropriate for those exhibiting unsatisfactory progress, yet not entirely hopeless, it is not always possible even in these cases to attribute an improvement solely to the specific medication. In addition to the remedial agent two factors may contribute quite materially to this result: the psychic element which is worthy of practical consideration among pulmonary invalids and the opportunity presented for closer observation and more careful direction. Even the fact of a demonstrable gain following the use of bacterial vaccines affords no actual criterion in all cases by which to estimate its specific medicinal effect. In the midst of the discouragement and pessimism engendered by periods of deferred hope, the moral uplift from the thought that something is being done is sometimes quite remarkable. There ensues an improved mental attitude, a better appetite and digestion, and an increasing spirit of co-operation. With more frequent

contact of physician and patient, the influence of which is far-reaching, there result mutual sympathetic relations productive of earnest interested effort on the part of each. Faithful compliance with instructions is thus secured, and a correspondingly greater medical efficiency. Caution should be exercised, however, lest following the initial enthusiasm the physician permit himself, in the frequent routine of vaccine administration, to devote insufficient attention to important details of management which constitute the very essence of any success to be obtained. The tendency under such circumstances to drift unconsciously from the recognized features of personal control may be quite pronounced. If this be carefully avoided and due advantage taken of the facilities afforded for more detailed supervision, it is quite conceivable that distinct benefit may accrue from vaccine therapy, quite irrespective of its specific action.

The cautious employment of bacterial vaccines, as previously stated, would seem to be appropriate chiefly for individuals who failed to show satisfying improvement under conservative management. It has been largely to this class of patients that I have restricted its use, as I could not consistently subject an invalid presenting every reasonable assurance of eventual recovery to the active influence of a therapeutic agent of uncertain value. It does not follow, however, that vaccines are indicated for all patients who are doing poorly. Such a broad classification would include not only those who, on account of the advanced infection, are clearly doomed to a fatal termination, but also others whose retardation of progress may be ascribed to important, though not hopeless, complications, or to the development of disturbing conditions capable of amelioration under resourceful management. In many of these cases the unfavourable factors are so apparent as to suggest change of environment,

removal of adverse influence, a more generous and appetizing cuisine, added opportunity for physical and mental repose, and closer attention to other details rather than to an abrupt recourse to a doubtful form of medication. In the absence of other pathologic conditions, in themselves explanatory of unsatisfactory general progress, and demanding special remedial measures, it may be granted that a demonstrated inability to respond favourably to an intelligent *régime* suggests the expediency of specific therapy. In my earlier experience with vaccines their application was largely confined to far-advanced patients, exhibiting a relentless decline with pronounced septic manifestations. All of these by virtue of every consideration ordinarily influencing prognosis were regarded as hopeless. In very many of the cases the course of the disease was uninfluenced, but in a few definite improvement was noted, while in one or two conspicuous instances the clinical picture was unexpectedly transformed. Upon the whole the results obtained in this class of patients have been extremely disappointing, and the impression has been received that but little if any encouragement is afforded from vaccine therapy under such conditions.

It would seem that the elaboration of protective substances within the individual from the introduction of a bacterial agent is most unlikely when, in approaching terminal states, the natural powers of defence have become exhausted. It is altogether probable that at such a time the machinery of immunization is inoperative from the flooding of the blood with bacterial products without capacity for resulting formation of antibodies. When therapeutic stimulation of the active protective processes is thus impossible, an attempt toward the development of passive immunization by the injection of antibodies contained in the serum of immunized

animals is justifiable, although likely to be of little avail owing to the difficulties of proper serum identification.

Notwithstanding the very proper objection to the rationale of this procedure, the fact remains that clinical experience has furnished evidence concerning its value in rather a small proportion of cases.

The fever of pulmonary tuberculosis, exclusive of the above-mentioned septic infections in advanced cases, may represent more than any other feature of the disease, a possible indication for vaccine therapy. A persisting elevation of temperature, independent of the nature and extent of pathologic change, represent an insuperable obstacle to recovery, and hence the application of therapeutic measures for its control is especially significant. It is necessary, however, to discriminate with the utmost care between the fever of mixed infection and that dependent upon other causes. It is, of course, absurd to expect benefits from bacterial vaccines when the fever is due to such unrecognized conditions as a pleural effusion, malaria, or miliary tuberculosis. Instances of this kind are by no means infrequent, as well as obscure gall-bladder infections, chronic appendiceal involvement, sinus disease, cystitis, and colon infection of the kidneys. A recent experience has been particularly instructive in that the fever of a young man, shortly after arrival in Colorado, with pulmonary lesions, was found to be produced by the paratyphoid B infection. This information was acquired only after blood cultures, several Widals, and an examination of the spinal fluid had elicited negative results, and the nature of the clinical manifestations had suggested a reasonable doubt as to the possible causal relation of a mixed infection, despite the detection of the secondary micro-organism in the sputum.

Elevation of temperature is not necessarily attributable

to the accompanying bacteria of mixed infection. That absorption of the toxins of the tubercle bacillus may be responsible for fever in some cases is generally accepted.

While the secondary bacteria of mixed infection may play an important *rôle* in the development of the pathologic processes common to tuberculosis, and exert an influence upon the clinical characteristics of the disease, similar constitutional manifestations may exist without recognition of the specific micro-organism in the sputum or blood, after repeated examinations. Even the detection of the accompanying bacteria in the sputum is not of itself sufficient to confirm an assumption that the mixed infection is the sole responsible cause for the clinical symptoms. Their presence at least affords no reliable measure of the severity of the infection and the relative gravity of the situation, which for practical purposes is best estimated by the extent of temperature elevation. The expulsion of bacteria with the tuberculous sputum in the absence of unfavourable clinical manifestations is no indication for the employment of bacterial vaccines. Even when apparently characteristic evidences of mixed infection are present an element of real doubt as to the propriety of vaccine therapy is unavoidable, as the symptom-complex may, after all, be of essentially tuberculous origin. Irrespective of these considerations as to pathogenesis, and with a just appreciation of the inevitable uncertainties of action, it appears, nevertheless, permissible to resort to vaccine therapy under the conditions enumerated.

In my experience the results obtained in a fair proportion of cases with moderate fever have been such as to encourage its further cautious employment. No assurances as to its probable effect can be given, and patients should be made to understand that its use is largely experimental. Under a

wisely directed management they have but little to lose from its trial, and perhaps something to gain.

This is also true to a large extent in connection with its employment in afebrile cases. While the greater proportion of such invalids may be expected to make fairly satisfactory progress under proper supervision without recourse to vaccine therapy, occasional indications for its administration may be found in patients with distressing cough and abundant expectoration. Many of these cases without fever exhibit more or less cavity formation or bronchiectasis with varying degrees of fibrosis. Under these conditions, even if there has taken place but slight loss of weight, the constructive change is necessarily slow, while, if nutrition is seriously impaired, the difficulties of successful management are very considerable. The application of vaccines to patients of this class is quite appropriate, and the results sometimes gratifying. Did opportunity permit, I could cite numerous cases under my own observation for whom the vaccines proved of appreciable benefit, and could present in person a few rather exceptional instances of the remarkable improvement sometimes achieved. Notwithstanding these decidedly picturesque examples which, though impressive, are infrequently observed, the fact remains that my own clinical experience suggests for vaccine therapy but a limited field of usefulness. As a routine method of treatment in pulmonary tuberculosis it cannot be too strongly condemned. As a special measure of occasional value, but often of doubtful utility, it appears worthy of a judicious trial in selected cases.

THE RELATIONSHIP OF SECONDARY INFECTION TO PROGNOSIS IN ALL THREE STAGES OF PULMONARY TUBERCULOSIS.

BY

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CONSIDERABLE work has been done in the past concerning the bacteria involved in the secondary infections of pulmonary tuberculosis with the endeavour, whenever possible, to correlate symptoms and the existing and probable etiologic organisms. Much difference of opinion exists on two points: first, as to the ability to isolate organisms from the lungs, and secondly, of how much importance these secondary infections really are. In regard to the first point, this has probably been due to the many different techniques used in culturing the sputum. This is becoming more and more uniform, consisting either in the careful washing of the sputum (not saliva) or in a period of mouth-cleansing before the sputum is collected. Early investigators often missed *B. influenza* because they did not use blood-agar media which Pfeiffer showed was absolutely necessary. In regard to the second point—the importance of these secondary infections—there seems to be less and less doubt as to its great influence. The tubercle bacillus has a very definite method of destructive action, but it is the invasion of these secondary organisms which have such easy access (through the air) that cause the fever and prostration which greatly handicap nature in its supreme effort to build up the general

condition of the patient, for when such takes place we know that the action of the tubercle bacillus is greatly diminished.

A brief *résumé* of the work done by several men in this country who cultured sputa of persons suffering from some kind of pulmonary disorder will be of interest. Ophuls [1], in 1901, made a very careful pathological and bacteriological examination of twenty-six cavities in thirteen fatal cases of pulmonary tuberculosis. In seven cavities he found a pure culture of tubercle bacillus; in all the others tubercle bacilli were present, mixed with streptococcus in one, pseudo-diphtheria in four, pneumococcus in six, pneumococcus and pseudodiphtheria in four, staphylococcus and streptococcus in two, and pneumococcus and stapyhlococcus in one; that is, pneumococcus or streptococcus were found pure or mixed with other organisms in fourteen or the eighteen cavities where mixed infection was found. In several of his cases the process was no longer a local one in the lungs, but involved the liver, spleen, and circulatory system, and the infecting organisms were streptococci and pneumococci.

In 1902-05 Lord [2] studied the sputum of 186 cases coming to the Out-Patient Department of the Massachusetts General Hospital with pulmonary complaint; none were definitely tubercular. His investigation covered a period of eighteen months, during which time there were no epidemics of pulmonary disease. In sixty-six cases (36 per cent.) one organism so far predominated that he felt justified that was the infecting agent. Of these sixty-six cases, forty-seven, or 71 per cent., showed *B. influenza* as the predominating bacteria. Organisms resembling pneumococci were present in 70 per cent. of the cases, but pure in only eight cases. Micrococcus catarrhalis was found pure in but five, while *B. mucosus capsulatus* and pseudopneumococci each predominated in three cases. He endeavoured to classify these bacteria according to their symptomatology and patho-

logy, but found that the same conditions seemed to prevail, whether the infecting agent was pneumococcus, influenza, or catarrhalis.

In 1909 Martyn [3] reported in his bacteriological study of mixed infections that 43 per cent. were due to *Micrococcus catarrhalis*. As to symptomatology, he suggested that the temperature was more elevated than with other infecting bacteria. The sputum was more abundant and purulent, and chills and sweats were present to a larger extent than his other cases. He found *B. pyocyaneus* in three cases, and the prognosis was correspondingly severe. As for *B. influenza*, *B. diphtheriæ*, and pneumobacillus and saprophytes, he found only a small number. His experience with the pneumococcus was similar to that of Watson Cheyne, who stated that this organism was responsible for secondary infections in 60 per cent. of his cases in children, and only 25 per cent. in adults, indicating the very much increased susceptibility of children to this organism.

Holt [4] expressed himself by saying that *B. influenza* was of great importance in infections of the lower respiratory tract in children, especially in cold weather, in distinction to acute naso-pharyngeal catarrhs and their complications (otitis and adenitis).

In 1911 Pettit [5] made an extensive study of the mixed infections in tuberculosis at the Ottawa Tent Colony in Illinois. In his work he made very careful blood cultures as well as sputum cultures, and found many more positive results in his blood cultures than previous observers. This was probably due to his very careful technique in collecting and planting his blood. Whereas previous observers had been able to obtain positive results in 2·4 per cent. of their cases, he recovered streptococci or pneumococci in 59 out of 130 cases, or 45 per cent., streptococci being found in 35 cases, and pneumococci in 24. Autogenous vaccines

were made both from sputum and blood, and the former seemed to have a very beneficial action in some ways, while those made from the blood were practically useless.

Leutscher [6] in 1915 made a study of the sputum of persons suffering from non-tubercular affections, and by using blood-agar plates the infecting organism appeared in pure culture in 95 per cent. of his cases. In general his findings were as follows: Pneumococci and *B. influenza* were the cause of 90 per cent. of infections of the lungs and bronchi; they were the cause of 74 per cent. of the infections of the larynx, and of 31 per cent. of the infections of the nose, throat, and sinuses. Streptococci were rarely found in the lungs; they were more frequently found in the sinuses and throat infections.

To very generally sum up the work of these few investigators, and many more might be mentioned, it would seem that pneumococci and influenza bacilli are responsible for a large percentage of the infections of the lower respiratory tract. The streptococci and pneumococci are more prone to enter the blood-stream and cause the exhausting bacteræmias.

The clinical material which furnished the basis for our work were patients at Arequipa Sanatorium and the tuberculosis wards of the San Francisco Hospital. Before cases are admitted to the sanatorium special care is taken to have the teeth and throat carefully examined and treated whenever necessary. This obviates a great deal of secondary infection in this common focus. The work of Ulrich [7] might be mentioned in this connection. In 500 persons examined a total of 1,350 dead teeth were found, and there were abscesses in 1,108, or 83 per cent., of these. It is also instructive to know that 68 per cent. of all devitalized teeth show apical abscesses, and that the predominating infecting organisms are *Streptococcus viridans* and hæmolyticus.

The technique pursued in the examination of these

Source	Number of cases	Influenza	Catarrhalis	Pneumococci	Staphylococci	Staphylococci Influenza	Streptococci	Pneumostreptococci	Pneumostreptococci catarrhalis	Pneumococci catarrhalis	Other bacteria
Sputum	47	13	8	5	6	3	2	3	1	1	2 Pseudo KL. Subtilis Large G. diplococci
Nose	8	2	1	—	3	2	—	—	—	—	—
Throat	3	2	—	—	—	—	—	1	—	—	—
Culture direct from lung	3	—	1	—	—	1	—	—	—	—	Subtilis

Stage	Number of cases	Influenza	Catarrhalis	Pneumococci	Staphylococci	Staphylococci Influenza	Streptococci	Pneumostreptococci	Other bacteria
First ...	17	5	1	3	2	3	—	2	—
Second...	17	6	3	1	5	—	1 and with catarrhalis	1	Pseudo-diphtheria
Third ...	35	6	6	1 and with catarrhalis 1	3	3	2	1 and with catarrhalis 1	Subtilis 2 Large gram negative diplococci 1 Pseudo-diphtheria 1

Symptoms	Number of cases	Source	Influenza	Catarrhalis	Pneumococcus	Staphylococcus	Influenza Staphylococcus	Pneumostreptococcus	Streptococcus	Other bacteria
Fever and increased sputum	21	Sputum	3	4	—	3	4	1	1	2 Pseudo KL. 2 Subtilis Large diplococcus
Coryza, cough, sore throat, increased sputum	12	Sputum	2	1	1	1	—	—	—	—
		Nose	2	1	—	2	2	—	—	—
Blood in sputum, with fever	4	Sputum	2	—	1	1	—	—	—	—
Blood in sputum, without fever	4	Sputum	3	1	—	—	—	—	—	—
Plurisy, fever, iucreased sputum	4	Sputum	1	1	1 and with catarrhalis	—	—	1 and with catarrhalis	—	—
Sputum increased, no fever	7	Sputum	2	—	2	—	—	1	1	—
		Nose	—	—	—	1	—	—	—	—
Sore throat	4	Throat.	2	—	—	—	—	1	—	—
		Section of tonsil	—	—	—	—	—	1	—	—
No symptoms	5	Sputum	—	2	1	1	—	—	1 and with catarrhalis	—

specimens of sputa was the following: Individual care was exercised in the collection of each specimen. They were not merely saliva, but the result of genuine coughing and raising from the lungs. This was expectorated into wide-mouthed sterile bottles, and cultured on the same day. A purulent piece of sputum was picked up on the sterile platinum hook and washed through six or eight Petri dishes containing sterile water, this being done to wash off all superficial bacteria which might come from the mouth. It is really only the centre of this little piece that is finally stroked out on blood-agar plates, and incubated for twenty-four to forty-eight hours. All different colonies are examined morphologically and culturely when necessary. The term "influenza group" seems a more correct term to use, for there are variations in this small Gram-negative bacillus which all coincide sufficiently with Pfeiffer's description to consider them as one of possibly several varieties of *B. influenza*. It will be seen from this very limited number of examinations that this influenza and pneumococcus group predominate in the sputum as representing lower respiratory infections. An attempt was made to correlate symptoms and their etiologic bacteria. As yet nothing very definite can be deduced. This report is a preliminary one, and more work along this same line with also the accompanying pathological aspect is to follow.

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A PRELIMINARY REPORT OF VACCINE THERAPY IN BRONCHIAL ASTHMA.

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For various reasons I have been able to investigate only a small number of cases, and while it is unjustifiable to draw any positive conclusions from so small a number, I present them for what they may be worth when taken in conjunction with reports of many other recent investigations along this line.

It is well known that a revolution in our conception of bronchial asthma has been brought about in the last six or eight years. Meltzer, in a paper before the Association of American Physicians in May, 1910, advanced the idea, based upon the work of Auer and Lewis in the Rockefeller Institute on anaphylaxis, that asthma was a phase of anaphylaxis. To quote:—

"The theory is here offered that asthma is an anaphylactic phenomenon—that is, that asthmatics are individuals who are 'sensitized' to a specific substance, and the attack of asthma sets in whenever they are 'intoxicated' by that substance."

It has been further shown that this substance is a protein, and that this protein can be taken into the system through the alimentary tract and the respiratory tract, or absorbed from other parts of the body (Vaughan). That this protein

is split up into a poisonous and a non-poisonous portion. The animal is sensitized to this particular protein, and any further entrance of this protein into the system produces the symptoms of anaphylaxis. Three years ago Dr. Babcock gave us, in his usual clear, practical way, an exposition of this question. Since then he has further added to our knowledge along these lines by two reports of his practical application of these principles laid down in his paper before this body.

The investigation of my few cases was stimulated to a great extent by his reports, and also by the striking results of one of my co-labourers, Dr. W. C. Moore, in relieving an old chronic asthmatic by an autogenous vaccine from the bronchial secretions.

These investigations were made by myself and assistants in the hospital, Dr. J. A. Jeffries and Dr. Cabell Moore.

No effort was made to find if the cases were sensitive to the various food proteins, except by thorough questioning.

All sources of infection elsewhere in the body were examined for, and their effect, if any, upon the production of the attacks taken into consideration.

All cases were treated with an autogenous vaccine made from secretions gotten as aseptically as possible from the lower respiratory tract. The methods used were as follows :—

The mouth and throat were cleansed as far as possible by a solution of permanganate of potash ; and the patient was told to cough up from as "low down as possible." This was expectorated into a sterile tube or bottle and sent to the laboratory, where according to Dr. Lester Neuman, the following methods were carried out : "The cultures were made, after washing in salt solution, on bouillon, agar, blood serum, and blood-streaked agar. The bacterial emulsion was standardized in the hemocytometer. The organisms

were killed in the water bath at 60° C. for one hour. Tricresol (·2 per cent.) was used as a preservative."

The last vaccine for Case 2, and vaccines for Cases 5, 7, and 8 were made by the National Vaccine Company. The following culture media were used by them: agar, blood agar, acetic agar, and beef broth. There seems as yet to be much variance as to methods and results of cultures. But the majority of investigators of the respiratory bacterial flora (Allen, Cecil, Stewart, &c.) lay much stress upon the use of blood agar made from human blood, fresh, and well mixed and plated.

Various organisms have been found in the cultures. Some emphasize one organism as a causative factor, while others lay stress upon another. Allen in fifty-one cases found the streptococcus in 96 per cent., and *Micrococcus catarrhalis* in 72 per cent. Babcock mentions a fusiform anaerobic bacillus as being present in a large number of his cases, but so far no single organism has been shown to be the predominating factor.

Case 1.—E. W., aged 49, male, white, single. Salesman, No familial history of asthma.

For last twenty-five years has had asthma attacks from one to three weeks apart, and varying in intensity. Seems to be affected almost entirely by the weather conditions. Dampness and cold increases it; in dry, warm weather he is fairly comfortable. Denver climate seems to suit him. *Attacks last* from two to three days to a week. Indiscretions in diet sometimes bring on attacks. Odours and gases have no effect.

The attack that he came in hospital with continued for two weeks, the usual iodides, &c., being given with little success. Vaccine was made from sputum collected aseptically. It contained *Micrococcus catarrhalis, Bacillus mucosus capsulatus*. Vaccine made with 200,000,000 each per cubic centimetre, October, 1915.

November 2, 1915.—First injection vaccine, 50,000,000.

Very slight reaction, but patient began to feel better at once; expectoration became less, and he had no more asthma after the second or third injection.

On damp days he would feel slightly uncomfortable, but no asthmatic attacks. Vaccine was given about every fourth to fifth day in increasing amounts up to 200,000,000 from November 2, 1915, to December 6, 1915. He left the hospital December 17, 1915, having been free from asthma since the beginning of the vaccine treatment. He said he had not been so free from attacks for many months. He went out of hospital and back to work, and was in hospital again with another attack in five days. This attack did not seem to be very severe.

The constriction in bronchi remained, though in mild degree, for two weeks, when another sputum culture showed the same organisms, viz., *Micrococcus catarrhalis, Bacillus mucosus capsulatus*, from which a vaccine was made of 200,000,000 each per cubic centimetre.

November 1, 1916.—First injection vaccine, 100,000,000.

No reaction to amount to anything, and was soon feeling well and free of bronchial constriction. Vaccine was given about every four days in increasing doses up to 400,000,000. Six injections in all. Went out February 7, 1916, feeling well. Has not been seen since.

Case 2.—W. H. S., aged 24, male, white, married. Clerk. History: One sister has asthma.

Asthma since 9 years of age every fourteen to fifteen days, and lasting four to five days. Begins day or night. November, 1914, had tonsils, adenoids, and part of right ethmoid removed, without definite alleviation of symptoms.

Careful history of attacks reveals no causative agent in alimentary tract or elsewhere, except some indigestion before attacks. Sputum was taken and culture made by Dr. Neuman. *Micrococcus catarrhalis, Diplococcus lanceolatus* found. Vaccine made from these with 200,000,000 each to cubic centimetre.

December 6, 1915.—Began with 50,000,000 dose, from which he had a rather severe reaction about six hours afterwards; this lasted two days and nights.

December 11, 1915.—Five days later had second injection of 200,000,000.

December 15, 1915.—Five days later had third injection by mistake of only 50,000,000. Slight drowsiness and headache was only reaction after these two injections.

December 20, 1915.—Five days later; *fourth* injection, 200,000,000. A slight attack the night before this injection. Three days after this injection he had an attack of asthma lasting three days. But much *less* severe than former attacks and *shorter* by two days, as he only lost *four days* from work, usually losing six days to each attack.

December 27, 1915.—Fifth injection vaccine, 400,000,000.

January 3, 1916.—Sixth injection vaccine, 400,000,000.

January 8, 1916.—Has an attack of asthma. Sputum freer since taking vaccine. Seventh injection vaccine, 400,000,000.

January 17, 1916.—Eight injection vaccine, 400,000,000.

January 24, 1916.—Asthma yesterday and to-day, but much less severe than usual. Lost only *one* day from work.

January 29, 1916.—More sputum got for another vaccine culture.

February 10, 1916.—Attack on February 5, 1916, but only for *one* day.

February 14, 1916.—New vaccine contains *Micrococcus catarrhalis* and *Diplococcus lanceolatus*, 200,000,000 to each cubic centimetre. First injection 300,000,000.

February 21, 1916.—Been well for a week. Second injection vaccine, 600,000,000.

February 26, 1916.—Attack to-day, but not severe—only every three weeks now. Is to have bad root of tooth removed. Third injection vaccine, 600,000,000 (last of vaccine).

March 13, 1916.—Caught cold on March 6, 1916, and was laid up with asthma, fever and chills, and aching. Tooth has been extracted. Sputum taken and sent to laboratory for vaccine.

March 20, 1916.—Been well past week. New vaccine, *Micrococcus catarrhalis*, 800,000,000 to cubic centimetre. First injection vaccine, 400,000,000.

March 27, 1916.—Moderate attack on 24th—two weeks after last one. Duration forty-eight hours. Second injection vaccine, 600,000,000.

April 1, 1916.—Slight rhinitis and slight asthma. Third injection vaccine, 600,000,000. He says all attacks have been less severe, and most of them shorter since taking the vaccine.

April 3, 1916.—Fourth injection vaccine, 600,000,000.

April 8, 1916.—Fifth injection vaccine, 600,000,000. Some asthma since April 3, 1916.

April 11, 1916.—Sixth injection vaccine, 600,000,000. Has had attack for five days. But none have been as bad as before vaccine treatment began.

April 17, 1916.—Asthma for three days. Seventh injection vaccine, 400,000,000.

April 24, 1916.—New vaccine made by National Vaccine Company contains: *Micrococcus catarrhalis*, pneumococcus, pseudo-diphtheria, Gram-negative bacillus, staphylococcus, streptococcus, 1,000,000,000 of each per cubic centimetre. First injection, 200,000,000. No reaction followed it.

April 28, 1916.—Second injection, 500,000,000.

Reaction very marked, for when he returned May 4, 1916, he reported he had the worst attack he had had in five months —lasting four days. Third injection, 1,000,000,000.

This case is still under treatment with improvement.

Case 3.—Coloured female, aged 35. No family history of importance. Had some years ago an eruption over body, papular, and confluent and left scars in places. Wassermann reaction is partial positive; single plus. Had asthma for ten years; began mild, and became severe since 1915.

Came into hospital on December 15 with attack of asthma. Went out on December 31, 1915. Came back January 2, 1916, acute attack.

This asthmatic condition remained in slight degree for two or three weeks. Sputum cultured showed *Staphylococcus albus*, *S. aureus*. Vaccine made of 300,000,000 each per cubic centimetre.

First injection of 50,000,000 given January 21, 1916. No reaction noticed. 50,000,000 given January 26, 1916, and 100,000,000 on January 31, 1916. She left hospital then, and came back on February 4, 1916—four days later—with an attack, but milder in character, and expectoration looser.

February 2, 1916.—Injection vaccine, 100,000,000. No reaction, but patient seemed to improve somewhat of her asthmatic condition.

Injection of 150,000,000 on February 11, 1916, and 250,000,000 on February 16, 1916. Her asthmatic condition improved while she was in the hospital.

But she also had some *vaginal* infection, as well as a salpingitis, for which she came in the hospital again on March 5, 1916, but her asthmatic condition at that time was markedly better.

This case is very unsatisfactory, and no satisfactory conclusion can be drawn from it because of the many sources of infection present and the time under observation. All we can say is that the asthmatic attacks, according to her own testimony, were much diminished.

Case 4.—Mrs. E. P., aged 69, white, female. Widow. Government clerk.

Family history negative.

At 25 years of age she had a "peculiar disease characterized by hæmorrhages from nose and mouth, and black and blue spots over body."

Seven years ago had bronchitis which terminated in asthma, and has had several attacks of asthma since then.

Entered hospital February 6, 1916, with attack of bronchial asthma. Sputum cultured, and *Micrococcus catarrhalis* and *Diplococcus lanceolatus* found. Vaccine made with 200,000,000 of each in cubic centimetre.

February 23, 1916.—The acute attack had somewhat subsided and patient left hospital, but returned for injections. First injection vaccine, 50,000,000. Rather severe headache day following first injection. No other signs.

February 27, 1916.—Second injection, 100,000,000.

March 2, 1916.—Third injection, 200,000,000.

March 7, 1916.—Fourth injection, 400,000,000.

March 11, 1916.—Had a slight attack of asthma lasting an hour on March 9, 1916, otherwise all right. Fifth injection, 400,000,000.

March 15, 1916.—Sixth injection, 400,000,000. No more attacks so far.

Case 5.—J., aged 36, white, male. Married. Physician. Maternal grandmother has asthma. Sister, 50 years of age, has suffered from asthma for first time—six months past—almost continuously.

Patient had asthma on exertion when a child 8 to 12 years of age. These disappeared until 24 years of age, when they returned at long intervals, after going to the country to

practice medicine and riding horseback all the time. In intervals between these attacks suffered with head colds. In New York City in 1906 he had turbinate bones clipped and operation on septum, followed by much relief. Before this time he slept in a room in the hospital next to a stable, on sixth floor of which horses were kept and the odours would come into his room. It gave him asthma for eighteen days without let up, until he moved his room to another part of the hospital, and got immediate relief. Has had slight attacks ever since upon exertion, but at very long intervals. Had not had an attack for twelve months until three weeks ago. Since then has had asthma every night, attacks coming on at 3 a.m. and lasting three hours. Has noticed that every morning from the time this last attack started a large number of polo ponies has been driven by his house; and also that about the time the attacks begin in early morning the street-sweeping forces, drawn by horses, go by his sleeping rooms. It is quite probable that this may be a case of so-called horse asthma.

But we have had an autogenous vaccine made from his sputum (by the National Vaccine Company), which is composed of Pneumococcus, pseudo-diphtheria bacillus, *Micrococcus catarrhalis*, Gram negative bacillus, *Staphylococcus aureus*, *Streptococcus aureus*, 1,000,000,000 each to cubic centimetre.

Fifty millions given first dose. 100,000,000 second dose, at interval of four days. No reaction from first dose, but a reaction from second dose. Third dose—200,000,000—four days later. No appreciable benefit so far.

Case 6.—E. M., aged 43, patient of Dr. Jeffries, white, male. Acute bronchitis January 8, 1916, fever, cough, &c. Shortness of breath and asthmatic in character. This continued until March 28, 1916, with tight cough and very little bronchial secretion. Culture was made from bronchial secretion, and *Staphylococcus aureus* only was found and vaccine made.

Fifty millions given March 29, 1916, and reaction shown by pain, swelling, and redness at point of injection, and sputum freely expectorated for twenty-four hours. Second dose in four days of 100,000,000; then 200,000,000, 500,000,000, 800,000,000, and 1,000,000,000, &c., until twelve ampoules of 800,000,000 were given.

After second dose the bronchitis disappeared entirely, and has not returned up to date. The patient gained 20 lb. and feels well.

Case 7.—G. B., aged 68, male. Married. Patient of Dr. W. C. Moore. Chronic bronchitis, asthma, and emphysema.

Extremely severe attacks, especially at night, requiring sometimes chloroform to relieve. Condition continued from bad to worse, patient having to sit up great part of time, with dyspnœa very marked. During this time he had "Pertussin" vaccine (combined), containing *Bacillus pertussis*, 50,000,000; *Streptococcus pyogenes*, 10,000,000, *Staphylococcus pyogenes aureus*, 20,000,000; *Micrococcus catarrhalis*, 20,000,000; *Bacillus influenza*, 20,000,000, per cubic centimetre.

This seemed to give a slight temporary relief of symptoms.

A month later an attempt was made to test his susceptibility to *Micrococcus catarrhalis* and Friedlander's bacillus by vaccination with a solution of killed bacilli. There was no reaction to either one.

A culture was then taken from the secretion from the bronchi and the following organisms found: *Micrococcus catarrhalis*, stapylococcus, streptococcus, a Gram negative bacillus. Culture was made aerobically and anaerobically, 1,000,000,000 to cubic centimetre, injections given beginning with 2,000,000 and increasing gradually up to 50,000,000. Intervals of about five days between injections.

Improvement began after second injection (of 30,000,000); the asthmatic attacks diminished gradually and expectoration became freer, and then, as the asthma disappeared, the expectoration became less.

He remained free of asthma for some months, and was able to spend a very comfortable summer. This patient, I understand, has passed from under the care of Dr. Moore, and that he has had a recurrence of his asthma.

Case 8.—Mrs. G., seen by myself and Dr. Moore. This patient, a Russian Jewess, was seen by me in the summer of 1915, complaining of cough, chills, night sweats, and loss of weight.

The cough was described as paroxysmal, and occurring

at night and very severe. Sputum examination for tuberculosis was negative, but physical examination showed some *slight dulness* in upper left chest. She also had several nasal polypi, which were removed. She was sent to the hospital for observation, and the night attacks were reported to be asthmatic. The routine treatment of iodides, &c., was given, with much improvement. But this was only temporary.

Later in the fall she came under Dr. Moore's treatment, and he had a culture made from her bronchial secretions, aerobically and anaerobically, and it showed aerobically: Staphylococcus, streptococcus, *Micrococcus catarrhalis*, Gram-negative bacillus, pseudo-diphtheria bacillus. Vaccine made of 1,000,000,000 per cubic centimetre.

This was given about every four to five days in increasing amounts, beginning with 50,000,000, and going up to 500,000,000 per dose, with no marked benefit. A vaccine was then made from the aerobic and the anaerobic cultures together, the latter showing a short bacillus emitting a very foul odour in culture.

This mixed vaccine was given in same manner as the first with no apparent benefit, after which two doses of the pure anaerobic foul-smelling bacillus of 200,000,000 and 500,000,000 respectively were given in same manner without any apparent effect upon the asthma. And at last accounts the patient who had passed from our care was as bad off as ever.

It is interesting to note that the anaerobic bacillus found in this case seems to be similar to the one found so often by Dr. Babcock in his cases. And that, contrary to Dr. Babcock's experience, the case having this bacillus did *not* improve, even though a vaccine of that alone was given.

DISCUSSION.

Dr. C. D. PARFITT: I have used bacterial vaccines in about forty cases, acute as well as chronic, and the results have been disappointing. The organisms have been grown from carefully washed sputa on blood agar. In a few of the acute cases the organisms have disappeared from the sputum with no lasting good effect. In a few of the chronic cases it has been difficult to tell whether the psychic influence has not been as important a factor in improvement as the vaccines. One chronic case in particular emphasizes the possible

usefulness of bacterial vaccines in diseases of the respiratory tract. This patient had been considered tuberculous and had some physical signs. He had a very tough sputum difficult to remove from the larynx. Small growths were actually embedded in the mucous membrane of the larynx which could only be removed by punch forceps. Pieces of this growth were removed, and from these an almost pure culture of a diphtheroid organism was obtained. After a few months' treatment with a vaccine the chest condition cleared up entirely. I have thought the vaccine must apply to the secondary infection when, by consistent increase of dose, a cutaneous, fœcal, or general reaction developed.

Dr. FLOYD (Discussing Dr. Thomas's paper) : I should like to speak of one point that I think is of importance. I have failed to note in the report just given that any tests were made to detect whether the body was sensitized to the various organisms used in immunization. It seems to me that this is the crucial point. If the body is not sensitized to the organism you are using your results may be negative. My work along these lines has shown that a series of organisms may be cultivated from the sputum, only one of which may sensitize the body. Several of the others may be used without result, and unless all are tested out on the patient we have no means of knowing which is the proper one to use. In doing this the difficulty is to get a proper extract of the various micro-organisms. The best method is that of making an extract over a water bath at 55° and then having the powder rubbed up with glycerine. The powder can also be put up in 1-10 solution of sodium hydrate with 5-10 solution of phenol. These solutions will give definite reactions on the skin in twenty minutes with aerola and redness, after the method of von Pirquet, if sensitization to them is present. In this way we may secure some indication that we are using an organism which is producing the sensitization and having to do with the bronchial asthma.

Dr. BONNEY : I will state only that it has been my rather unfortunate observation that a great many people are subjected to the use of bacterial vaccines, very often stock vaccines, without there having been made any investigation as to the nature of the infection. It has been this tendency which made me feel like sounding a note of warning as to the indiscriminate continuance of vaccine therapy. One of my patients recently came to Colorado from a great distance, with a letter from her physician telling me what he had been using in the way of specific therapy, which included a preparation of tuberculin—a stock vaccine of six different micro-organisms and a serum—with instructions that I continue this treatment!

Dr. FREMONT SMITH : I perhaps should be appointed the historian of this Society on the question of the subcutaneous treatment of tuberculosis, inasmuch as I studied the subject under Koch—before it was called tuberculin—when it was known as "Koch's lymph." When

Koch's method was first brought forth the furore throughout the country was so extreme that every man who could afford to do so went to Berlin to make a study of it. I also went. Two years before that time I had been made a member of this Society, and I felt under a certain obligation to the Society. While I was in Berlin I sent back a paper to the *New York Medical Record,* which Dr. Shrady had asked me for, and in that paper I reported my observations in the Koenichlicher, Moabit and the Charité, on many hundred patients treated according to the German method, without regard to their desires, for the purpose of securing fever reactions, nearly all fading out under this plan. The paper I sent back was of such a character that Dr. Shrady wrote me to Berlin: "I am publishing your paper with great reluctance, because it is so contrary to the opinion of other observers." I brought back with me a small vial of tuberculin—or Koch's lymph—and at St. Augustine, where patients had gathered from all parts, I began to treat my cases. As they were being worn out in Berlin by this production of fever reaction, I began with the opposite purpose of avoiding reaction, and began by giving 1/10 mg. or less and then advancing the dose, never producing fever reactions, or if they occurred reducing the quantity at once to below the reaction dose. And so far as I am aware I was really the first practitioner to undertake that plan of treatment, which proved successful in a moderate number of cases.

Dr. BARNES: I have been much interested in Dr. Brown's paper because we have been doing somewhat similar work in our institution during the last three or four years. If Dr. Brown intends to work a year or two on this subject as I understood him, I suggest that he consider using Hasting's method of mouth technique and Kitasato's method of sputum washing, so that he may be able to separate influenza infections of the upper from those of the lower air passages. We overlooked these methods in our work.

HELIOTHERAPY IN ABDOMINAL TUBERCULOSIS.

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The value of heliotherapy in the treatment of certain forms of so-called surgical tuberculosis has been definitely established. Especially satisfactory results have been reported in tuberculous disease of bones and joints, both in closed cases and those with discharging fistulæ. In the latter there is frequently involvement of the skin as well, at the opening of the fistulous track. Contributions on the subject have been presented to this Association by Brannan and Hinsdale. Gardiner last year related some experiences with sunlight in the treatment of pulmonary tuberculosis. Other Fellows, Klebs, Pottenger, Pryor, and Twitchell have recorded their views elsewhere, principally dealing with infections of bones and joints or with pulmonary disease. With the exception of Pryor's work, the cases have been treated under conditions involving rest in places which have recognized value as health resorts—the Swiss Mountains, Colorado, California, or the seaside, as recorded by Brannan in his story of the work at "Seabreeze."

Pryor has demonstrated the possibility of securing good results at an inland point which boasts of no altitude, and I think I am correct in saying the hours of sunshine are less than those clouded.

My earlier experience with heliotherapy was some several years ago, when a group of men with pulmonary tuberculosis would take a row boat, and each day the weather would permit them, would spend several hours in the sun on a near-by island. Most agreed that they were deriving benefit from their treatment, but I could not satisfy myself that their improvement could be ascribed wholly or even principally to the sun exposure. One of my patients has written: "The psychological effect upon the patient as treatment progresses is worthy of note. There is a certain feeling of well-being when basking in the sun, pleasant dreams are dreamt, and visions of happier days to come flit before the mind." This group of men did well, but no doubt the mental effect was as important, and probably more important than the physical. They got away from their verandahs and petty verandah gossip; they could see no painted walls from where they basked in the sun, but only great rocks of gneiss and granite clothed here and there with the foliage of the wilderness.

The treatment of abdominal tuberculosis to which I wish to refer has been carried out within the confines of a large city with no particular climatic advantages outside the long days of midsummer with many hours of sunshine, or the bracing effect of keen bright winter days which are uncertain as to the month of their appearance, as well as to their duration. In fact, we may scarcely lay claim to the possession of climate, but have instead, what our good friend and Past President, W. F. R. Phillips, would doubtless prefer to describe as weather.

Toronto is a city of 500,000 people, situated on the north shore of Lake Ontario. The mean temperature for a series of years is 44·4°; the total precipitation 34 in., 6½ in. of which is represented by the mean snowfall of 65 in.; relative

humidity is 77. The yearly average of hours of sunshine is 2,048, or 5·61 daily, which is 46 per cent. of possible. Even with this percentage of sunshine exceedingly good results may be obtained.

I have had experience with three types of abdominal tuberculosis which have responded to heliotherapy.

(1) Tuberculous enteritis.

(2) Tuberculosis of the ileo-cæcal and appendix region.

(3) Tubrculous peritonitis with ascites.

(1) Tuberculous Enteritis.

Illustrative Case.—N. W., aged 19. Single.

In May, 1913, had a slight "cold," which persisted. There also was debility. The site of her pulmonary lesion was at first difficult to place, yet the diagnosis was clear, and tubercle bacilli were present in the sputum. The summer was spent in Muskoka under careful medical supervision with but little apparent benefit. After her return to Toronto in the autumn improvement set in, and in a few weeks cough and sputum ceased entirely. The pulse-rate remained elevated and strength did not return, nor could we secure any marked gain in weight; appetite remained poor. This condition continued throughout the winter and early spring, making one feel that at any time a fresh outbreak of her disease might be expected. Later a cough with fever developed, with very definite physical signs in the left upper lobe, and in the month of May, 1914, a troublesome diarrhœa set in. This continued throughout the summer; the temperature chart for over three months resembled that of typhoid. The usual remedies were tried without marked benefit, and the patient became quite emaciated. The cough continued, and tubercle bacilli were abundant in the sputum.

Toward the end of the summer of 1914 heliotherapy was begun and improvement soon set in. The diarrhœa gradually lessened as the temperature began to fall; appetite, which had been practically absent for a year, began to return, and in a short time it was evident that the patient was gaining in weight. The retraction and dough-like feel of the

abdomen soon lessened. The sun exposures were begun in the patient's bedroom, which had a southern exposure, as no protected sunny porch was available. Strength gradually returned, and the typhoid-like weakness and emaciation notably lessened. A little later she was moved into a tent in the garden, from which longer daily exposures were possible. With the improvement in the abdominal signs and symptoms there was noted a decrease in cough and expectoration, with a corresponding lessening in the physical signs of active disease in the left upper lobe.

By October she was able to visit my office. Her weight now was 137½ lb.; her last previous weight in April was 90 lb. During her enteritis she must have fallen to 75 lb. or 80 lb., perhaps lower.

The cough and sputum gradually ceased. In December she went to Asheville for the winter, but weather conditions were not found to be better than at home. She soon undertook exercise; strength returned, and on her return to Toronto weighed 127 lb., no cough, was walking fifteen minutes daily, pulse 60 at rest, 72 after exercise; examination of the abdomen, negative.

By June, 1915, she was walking forty-five minutes daily, and stated that she never felt better in her life.

At present she is able to take full exercise; pulse and temperature normal; physical signs in the left apex those of a healed tuberculosis.

(2) Tuberculosis of Ileo-cæcal and Appendix Region.

Illustrative Case.—P. W.

First sign of tuberculosis in July, 1912. Severe pulmonary hæmorrhage, followed by a period of fever. Seen by me in September of the same year, showing extensive physical signs of consolidation in left upper lobe from second to fifth rib in front, and both posterior apices and most of scapular region; pulse 110 to 120 at rest; sputum, at first rather less than 1 oz., gradually lessened, but showed bacilli for two years. Physical signs posteriorly gradually cleared, but those of consolidation and excavation persisted to the left of the area of cardiac dulness.

During the winter of 1914-1915 the patient complained of abdominal pain soon after beginning a meal, at first only

at luncheon, but later at dinner as well. The pain was across the abdomen at or below the navel. When eating in bed and using a hot-water bottle the pain would be less or absent. It would often last one to two hours. Examination, February, 1914, showed lower border of stomach at about level of umbilicus. Splashing present one hour after breakfast. Slight rigidity over right iliac fossa, tenderness at McBurney's point and below, palpable thickening in this area, pain on deep pressure radiating up toward stomach. Seen by Dr. Parfitt in consultation and by a surgeon, who agreed with diagnosis; operation seemed advisable because of slight evening fever, 99° to 99·4° F., and because of interference with nutrition. The consulting surgeon did not wish to undertake an operation, fearing the result would not be satisfactory. Sputum at this time increased, appearing through the day as well as formerly in the morning.

With operation refused by the surgeon, heliotherapy was instituted in May, 1914. He had been on rest cure on an open porch for a year and a half day and night, summer and winter, pulse rarely below 110 during the whole time, slight daily rise of temperature, appetite had become very poor, and because of the severe abdominal pain it was impossible for him to take the nourishment he needed.

At the end of three months he was able to expose himself for three hours each morning and two hours each afternoon. The abdominal trouble gradually disappeared, and an operation was no longer considered necessary. At the end of four months he had gained 30 lb. in weight, the cough had disappeared, sputum became very slight and was mucoid, and tubercle bacilli were no longer to be found. During the winter months he exposed himself but little. Last spring the exposures were again undertaken, sputum ceased, and his physical signs and symptoms are now those of healed pulmonary tuberculosis, with all abdominal signs and symptoms absent.

(3) Tuberculous Peritonitis with Effusion.

Illustrative Case.—F. W. Rather acute onset simulating typhoid fever.

In second week with Widal negative and signs of effusion diagnosis of tuberculous peritonitis was made. The effusion

increased until abdomen became much distended, and he was admitted to St. Michael's Hospital. Temperature was persistently high for many weeks, and there was no definite improvement until heliotherapy was instituted. The temperature then gradually fell. Throughout the winter of 1914-1915 his bed was kept alongside a window with south aspect, and the sun was far enough in the south to allow exposure from about nine to one each day. On mild days the window was completely raised. His body became well browned, and as this increased, the fluid decreased. In February he developed a friction rub on the side exposed to the draught from the open window, but no effusion was at any time demonstrated. Before the warmer weather of spring arrived he had overcome completely the evidence of toxæmia, all signs of peritoneal fluid was absent, and the pleural friction was no longer present.

He was soon able to leave the hospital, and has had no return of symptoms.

Method.

The patients treated out of doors used the Adirondack recliner, or similar chairs; those treated indoors in winter, a hospital bed of proper height. Treatment was begun with exposure of the feet to the direct sun for ten minute periods twice during the day, once in the morning and one after the rest hour in the afternoon. On the following day the abdomen was similarly exposed, increasing the exposure of the arms and legs by ten minutes each day; that is, by five minutes morning and afternoon. By this method a progressive pigmentation of the skin was procured. One patient noted that on a cool, clear day the sun burns more intensely than on a hot, humid one, and with less warning of discomfort, so that if care be not observed painful blisters would result. Cloudy days interfered with the treatment, but benefit was no doubt derived from simply exposing the body to the air. Screens may be arranged about the patient to ensure privacy

and to break the force of unpleasant winds. When the sun is hot the head is to be shielded from the direct rays of the sun, and smoked glasses are used to protect the eyes. One patient found that a sponging followed by an alcohol rub taken after exposure increased the feeling of well-being, and would lower the pulse-rate if increased.

Patients must be warned against the danger of insolation, symptoms of which may appear and prove very unpleasant, if not dangerous, if too rapid increase is made in the exposure periods.

Summary.

In abdominal tuberculosis heliotherapy would seem to be a valuable addition to simple rest cure in the open air.

Good results can be secured at home and in hospital.

The method is applicable even in large cities which have no special climatic advantages, as demonstrated in a city with 46 per cent. possible sunshine.

PATHOLOGICAL PROCESSES IN THE LUNG ASSOCIATED WITH BRONCHIAL ASTHMA.

By BAYARD T. CRANE, M.D.,
RUTLAND, MASSACHUSETTS.

A SEEKER after definite and established truth will not be satisfied with the present literature concerning bronchial asthma. He will turn away confused.

Bronchial asthma is considered by some as a disease and by others as merely a symptom. The channels involved in its causation are extremely diverse, if not unknown.

The purposes of this communication are—

(1) To review some of the literature as first hand evidence of the unsettled state of the question; and

(2) To call attention to the presence of well-marked pathological processes to be found in the lung in an appreciable percentage of cases of bronchial asthma;

(3) To introduce the presumption that these pathological processes may have some causative relation with the disease;

(4) To urge that patients suffering from bronchial asthma should be subjected to a very thorough and detailed physical examination, including a special and capable examination of the lungs, and by "special and capable examination of the lungs," I mean nothing short of an examination by a lung specialist, as a rule.

Quotations from the Literature.

"Of special pathology there is practically none, such changes as are found being secondary, in the form of emphysema, bronchitis, or dilatation of the right heart. It is characterized by spasm of bronchi and respiratory muscles, including also the diaphragm, and is followed by a vasomotor disturbance in the mucous membrane of the bronchi, large and small. [1]

In Rokitansky's "Pathological Anatomy," vol. iv, under "The Pathological Anatomy of Organs of Respiration," no mention is found of the pathology of bronchial asthma.

"Asthma and Hay Fever." [2] "Lesions are not marked. There are hypertrophy and widening of the bronchial tubes, with thickened mucous membranes, emphysemia of air vesicles; chest barrel-shaped."

"Asthma: General Features." [3] "The lungs are at times found to be emphysematous; at other times, however, nothing of the kind can be detected, nor may there be any other apparent morbid substratum to account for the disease."

In "Pathological Anatomy," by Delafield and Prudden (1892) asthma does not appear in the index.

Similarly, it is not mentioned in the text-books on Pathology by any of the following: Coates, Green, and Woodhead.

Cohnheim in "Lectures on General Pathology" (vol. iii, 1890), after a general discussion of the customary theories of the disease, presents no pathological reports, leading one to presume that if such an experienced pathologist presented no pathological observations, then it is fair to assume that the disease rarely comes to autopsy, and that consequently the chief knowledge of pathological processes associated with this disease must be obtained from the clinician.

In five cases of typhoid bronchial asthma examined by Epstein with a bronchoscope all cases showed a marked swelling and œdema of the mucous membrane of the bronchi, which were covered with a tenacious mucus. He states that the reflex or neuropathic type form a greater part of asthma cases.

"Asthma is due to pressure on asthmatogenous areas in the small fossæ" (of the nose). [4]

Dieulafoy (vol. i, 1911) states under "Pathological Anatomy" that "The attack of asthma is certainly produced by spasm of muscles of respiration. Difficulty begins when we try to decide which muscles are affected."

Butler (1911), under "Bronchial Asthma," says: "The pathology of this disease is unsettled. Some regard it as a pure neurosis, a spasm of the bronchial muscles; others as a neurotic hyperæmia and swelling of the bronchial mucosa, with an exudate of mucin. It is probable that the second view applies to the majority of cases. It may alternate with neuralgia and epilepsy."

From the above quotations taken from the literature one concludes that there is no unanimity of belief as to the pathology and *modus operandi* of the disease.

Personal Observation of the Presence of Pathological Processes in the Lung Associated with Bronchial Asthma.

In presenting a somewhat new point of view on a subject which is already confused and unsettled one is apt to add still further confusion. This is not my purpose. I wish merely to report my observations in a limited number of cases, if for no other purpose than to promote discussion and stimulate further study of a confused question. If the disease under discussion were one which

frequently comes to autopsy, one would be extremely hesitant in presenting observations based purely on clinical examinations. However, clinical observation is of necessity the chief source of information concerning the extent of pathological processes in the lung or elsewhere in this disease. If clinical examination of the chest had been developed to an exact science in the hands of all practitioners in the past, surely their reports would be sufficient evidence to judge of the existence of pathological changes in the lungs. But since it is true that exact examinations of the chest are made by only a small minority of practitioners, it is easy to see that in cases of asthma, which, as a rule, probably remain in the care of general practitioners, many cases may have had pathological processes without being recognized. I do not wish to be understood as going so far as to claim that no cases of asthma are associated with pathological processes without being recognized, but that the prevalence of inexact lung examinations has left the possibility of pathological processes being overlooked.

The basis for my attitude is the fact of finding *undoubted infiltration or induration in certain cases of typical bronchial asthma* in my experience, and also the finding of tuberculosis and asthma in association in certain cases where either one or the other condition had been previously unrecognized. Of course, it may be that these local pathological processes may have no causative relation to the asthma, and yet it would seem reasonable to suppose that they may, and unreasonable to assume that they do not.

Few text-books which I have seen make more than passing mention of a co-relation between asthma and other diseases. The following paragraph taken from Dieulafoy is suggestive, however :—

"A form of pulmonary tuberculosis simulates asthma,

and is known as pseudo-asthmatic. I am not speaking of acute miliary tuberculosis, which Andral compared to asthma because of the continuous or paroxysmal dyspnœa, but I allude to ordinary chronic tuberculosis. Certain tubercular patients at the outset, or during the course of their malady, suffer from attacks of asthma, and the tuberculosis may be overlooked if we forget this pseudo-asthmatic form."

Also in discussing peri-bronchitis, Jacobi has the following to say: "In some young, in too many adults, the further development of peri-bronchitis and interstitial pneumonia may be that into *asthma*, emphysema, bronchiectasis, abscess, gangrene, cavities, and death."

Jacobi would prefer to call this process "pulmonary hyperplasia with secondary cirrhosis."

The case of bronchial asthma, which I will describe in further detail later, had an indurated area in the lung which may be a case of interstitial pneumonia.

Dr. F. I. Knight wisely remarked that "The specialist is familiar with one kind of asthma according to his field of practice."

"One rhinologist claims intra-nasal disease in 90 per cent. of the cases, and Dr. Salter said that 80 per cent. of the asthma in the young dates from some acute inflammatory affection of the lungs, and led Berkart to put the proportion to this cause as high as 90 per cent."

One theory of the disease is that it is a pure neurosis. *A dependence upon the literature on the subject would lead one, it seems to me, to overlook the possibility of the existence of some pathological condition because of the emphasis placed on the neurotic theory.*

The purpose of this communication is to emphasize the fact that definite pathological pulmonary processes are to be found frequently associated with asthma. Is it not quite

possible in such cases for these pathological processes to be part or all of the exciting cause? If so, a relief of the symptoms would depend upon recognition of these pathological processes. If the attending physician is not alive to the possibility of associated disease with asthma, he would be apt to overlook a pulmonary tuberculosis, for instance, on the assumption that the cough and expectoration were the catarrhal symptoms of asthma.

Do Pathological Processes have any Causative Relation with Bronchial Asthma?

In the absence of conclusive evidence of the real processes of creation of the disease it is unwise to make positive answer to this question, but it seems fair to assume that, given a sensitive area in the lung where a pathological process exists, this area might well act as the excitant of a stimulus travelling along the nerves and inducing a reflex spasm of the bronchial muscles. Furthermore, an abnormal area in the lung, because of its greater tendency to congestion and inflammation might well be, because of its being an area of lowered resistance, the nucleus of an inflammatory process from which an inflammation might extend to the neighbouring tissues, and assist thereby in establishing a bronchitis, which is such a frequent associate with asthma.

Illustrative Cases.

(1) Farmer, aged 55, seen in the spring of 1915 in a severe attack of expiratory dyspnœa, which came on in a period of wet weather shortly after loading a quantity of old hay. He was fractious and irritable by nature, and recently had had extra cares arising from the purchase of a new home which he had just moved into. The attacks were worse at night, and required for several days hypodermics of morphine and atropine. Physical examination showed high blood-pressure, arterio-sclerosis, and an area, somewhat

larger than a cocoanut, in about the centre of the left lung, of marked dulness, marked broncho-vesicular respiration, and increased voice sounds. Sputum was muco-purulent, about 1 oz. in twenty-four hours, tenacious, and did not show tubercle bacilli. This man had had attacks for about fifteen years. The history did not reveal clearly the origin of the localized pulmonary induration.

(2) Teacher, female, aged 27, seen in April, 1916. There was a history of repeated "colds" in summer of 1915, culminating in well-marked prostration in October, 1915, and in distressing attacks of expiratory dyspnœa at intervals of a few weeks. Cough and expectoration chiefly in the morning, but after unusual exposure the attacks of dyspnœa develop and last for two or three days. Slight loss of flesh, anorexia, lassitude, and mental irritability.

P. E.—A "high-strung" woman of phthisical aspect. Heart negative. There was moderate dulness on right side of chest down to fifth rib, broncho-vesicular respiration, rare râles, and increased voice sounds. This woman had been treated first for "stomach trouble," and then for "asthma and bronchitis" without benefit. My diagnosis was pulmonary tuberculosis and asthma.

(3) Female, married, aged 35. Neurotic temperament, overworked, and harassed. Had had extreme attacks of bronchial asthma, treated chiefly by whisky.

P. E.—Showed slight signs of pulmonary tuberculosis right apex.

These cases serve as types. In the nature of things cases are apt to be so few as to be inconclusive, but they nevertheless have "opened my eyes," and have led me to wish for more information before claiming to thoroughly comprehend this distressing malady.

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APPENDICITIS AND PULMONARY TUBERCULOSIS.

By HUGH M. KINGHORN, M.D.
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The facts which are presented in this communication were obtained from my cases of pulmonary tuberculosis which were treated at Saranac Lake, N.Y., by the usual open-air method from October, 1905, to December, 1914.

Patients that undergo climatic treatment for pulmonary tuberculosis have comparatively few serious digestive disturbances. One would hardly expect this to be so, as they are taking an increased diet, and many are taking either no exercise whatever or a limited amount of exercise. These patients, however, are constantly in the open air, and their whole habit of life is such as to keep them in the best possible physical condition. The digestive system seems to respond to the increased strain put upon it, and, unless there is some organic condition somewhere in it, it usually gives little trouble.

All lung specialists place great importance on a good digestion as an important requirement to give a good prognosis to cases with pulmonary phthisis. A patient with a bad digestion will always be given a guarded prognosis. It goes without saying that the examination of the patient is not complete without a careful inquiry into the digestive

system, and also a careful physical examination of the abdomen.

Appendicitis and intestinal tuberculosis are the two organic conditions in the intestines which are most frequently met with in treating patients with pulmonary tuberculosis.

It is well known that intestinal tuberculosis is one of the most serious complications that can occur in the course of cases of pulmonary phthisis. Up to the present time it has been considered to be a terminal complication. When our patients have developed positive symptoms of intestinal tuberculosis we have given them an absolutely bad prognosis. This rather hopeless view may be modified in the future, as some of these cases of intestinal tuberculosis may be much benefited by operation—that is, by removing the disease in the bowel if the disease is not too disseminated. Up to the present time the results of operation have not been very encouraging.

The majority of the cases of appendicitis occurring in patients with pulmonary tuberculosis have the usual classical symptoms. There are several types of cases which are not classical and which can easily be overlooked. One is that type of case in which there are more or less chronic symptoms of intestinal indigestion. The symptoms may be hardly definite or severe enough to direct our attention to the appendix, but by examining this organ we may at last find that the symptoms are due to a chronic appendicitis. My attention was first directed to such cases by Dr. J. R. Byers, of the Laurentian Sanitarium of St. Agathe des Mont, P.Q., Canada. He informed me that he had given relief by operation to a considerable number of patients who had had these chronic symptoms of intestinal indigestion, and which he had found to be caused by the appendix. I have found this to be true.

Another type which is frequently met with in tuberculous patients occurs as a mild appendicitis. It frequently happens that the physician is called to see the patient on account of cramps in the abdomen. Advice may be asked of the physician over the telephone, as the patient may think that the cramps are of no importance. Such patients are usually taking a considerable quantity of milk. The usual advice given is for the patient to stop taking milk for some days and to take a dose of castor oil or some other purgative. The results that follow these directions are usually good, and frequently nothing more is heard from the patient. This, however, is not a safe procedure. It is much safer to see the patient and examine the abdomen. The physician will frequently find that such cramps are due to an appendicitis. I recall one case where the cramps were of so slight a nature as scarcely to demand an examination of the abdomen. This case went to abscess formation and a fæcal fistula. Had an examination of the abdomen been made at the onset this condition would have been avoided. In another case the patient complained only of vomiting and of no pain in the abdomen. Examination revealed a well-defined mass about the appendix and marked tenderness over this organ.

There is still another masked form of appendicitis, which is emphasized by Dieulafoy, and which we occasionally meet with in our pulmonary cases. The onset of this form is by diarrhœa. If our patient has been taking large quantities of milk we are apt to think that the diarrhœa is due to the milk. We have become so accustomed to see constipation accompany appendicitis that we may not recognize appendicitis accompanied by diarrhœa. An error in diagnosis may then readily occur. If a patient has abdominal pain and diarrhœa, we should make frequent physical examinations of the abdomen and try to find the seat of the pain.

(1) Frequency of Appendicitis in Cases of Pulmonary Tuberculosis undergoing Climatic Treatment.

From October, 1905, to December, 1914, I treated 674 cases of well-established pulmonary tuberculosis. They were all under climatic treatment at Saranac Lake, N.Y. Of this number there were 393 males and 281 females. The total number of cases of appendicitis in the 674 patients was 38 = 5·6 per cent. Of this number, 26 were males and 12 were females. It is thus seen that the disease was more prevalent in the male than in the female. For instance, of the 393 males, 26 had appendicitis = 6·6 per cent.; while of the 281 females, 12 had appendicitis = 4·2 per cent. As regards age, 3 cases occurred up to and including 20 years; 18 occurred between 20 and 30 years (excluding 20 and including 30), 12 between 30 and 40 years, and 5 between 40 and 50 years.

These figures are similar to those obtained from the records of cases of appendicitis that occurred in apparently healthy persons. In my series, as well as in all tables of statistics of the disease, it is seen that the disease is distinctly one of early life. The majority of cases occur up to and including the thirtieth year of life. Between 31 and 40 years a fair proportion occurs, while after 40 years the disease diminishes.

Sex plays a certain part, as the disease occurs in males more frequently than in females, according to all observers. There is no satisfactory explanation for this fact. Some authors have believed that the additional blood supply obtained in females through the appendiculo-ovarian ligament prevents obliteration of the circulation, thus obviating an important cause of the disease.

(2) Frequency of Operation.

Of the thirty-eight cases of appendicitis, twenty-five were operated upon = 65·7 per cent., and thirteen recovered without operation = 34·2 per cent. Of those that underwent operation, some were operated upon during the attack and others during the interval. Of those that did not undergo operation, the symptoms were so mild in character as not to demand operation.

(3) Prognosis.

Of the twenty-five cases that underwent operation there were two deaths = 8 per cent. Both occurred on the third day following operation. The first case was one of fulminating appendicitis, and though operation was performed within twenty-four hours of onset of the attack, there was already infection of the peritoneum, and he died on the third day after the operation. The second case was operated upon in the interval. He had suffered from a mild attack of appendicitis, but a swelling in the right iliac region persisted. The diagnosis in this case was a probable case of localized intestinal tuberculosis. At operation this proved to be correct, and the appendix, cæcum, and ileo-cæcal valve and part of the ascending colon were found to be tuberculous and were removed. On the third day after the operation he sank rapidly and died. The cause of his death was regarded as delayed shock, but no *post-mortem* examination was made of the abdomen. Chloroform was used on the first case, and local anæsthesia of novocain and adrenalin chloride and then nitrous oxide on the second. All of the twenty-five patients seemed to act well during the operation, and there were no deaths on the operating table.

The mortality of this series of thirty-eight cases (operative

and non-operative cases) was 5·2 per cent. (that is, two deaths in thirty-eight cases).

Of the acute cases that underwent operation there was a mortality of 11·1 per cent. (one death in nine cases). Of the interval operations there was a mortality of 6·2 per cent. (one death in sixteen operations). At this operation the appendix was removed and also a large proportion of the intestine, which was tuberculous. He died on the third day as a result of delayed shock.

It is of interest to compare this mortality which occurred with patients suffering from pulmonary tuberculosis with the mortality which occurs with patients free from tuberculosis.

Rotter's (Osler's "System of Medicine," vol. v, p. 429) statistics show that of 213 cases 8·9 per cent. died. In twenty-one cases there was diffuse peritonitis on admission to the hospital. Of these, seven, or 33·3 per cent., recovered, while fourteen, or 66·6 per cent., died. The latter accounts for nearly two-thirds of the total mortality of 8·9 per cent. Of 192 cases with circumscribed perityphlitis, 156 (82 per cent.) recovered under medical treatment. Of the remaining thirty-six cases, thirty-three were operated on and two died; three died without surgical intervention. There were, therefore, only five deaths (2·5 per cent.) among 192 cases of circumscribed perityphlitis.

Treves states that the general mortality of perityphlitis in all its aspects has been estimated at 11 per cent. (Treves' "System of Surgery," vol. ii, p. 627). If an abscess form the mortality is raised to between 30 and 40 per cent.

Sahli collected 7,213 cases, of which 473 were operated on, while 6,740 were not. Of the latter group 91 per cent. recovered. Recurrences took place in 4,593 cases; and of these 3,635 recovered without further recurrences (*loc. cit.*).

Up to the beginning of the year 1909 Schnitzler had

operated on 2,000 cases: 1,063 interval operations, with a mortality of 0·47 per cent. (five deaths), and 937 acute cases, with a mortality of 10·5 per cent. (ninety-nine deaths). It is thus seen that in these 2,000 operations there was a mortality of 104, or 5·2 per cent. (Keen's "Surgery," vol. vi, p. 553).

Comparing my series with these series one sees that patients with pulmonary tuberculosis undergoing climatic treatment stand the operation for appendicitis exceedingly well.

The following tables are copied from the article by E. MacD. Stanton, which appeared in the *New York Medical Journal* for September 26, 1914:—

"THE PROGNOSIS IN ACUTE APPENDICITIS."

By E. MacD. Stanton, M.D., F.A.C.S., Schenectady, N.Y.

Table I.—Results Reported by those Advocating Immediate Operation.

Reporter	Years	Acute cases	Deaths	Per cent.
Denk	1907-1911 ...	467 ...	29 ...	6·2
Burgess	1906-1911 ...	500 ...	40 ...	8·0
Syms	1906-1912 ...	106 ...	8 ...	7·5
McWilliams	1906-1909 ...	687 ...	68 ...	9·8
A. V. and E. Moschcowitz...	1903-1906 ...	842 ...	67 ...	7·9
A. V. and E. Moschcowitz...	1899-1902 ...	(661) ..	(135) ...	(20·4)
Total of recent series		2,602	212	8·1

Table II.—Results Reported by those Advocating Delayed Operation in Severe Intermediate Stage Cases.

Reporter	Years	Acute cases	Deaths	Per cent.
Ochsner	1904 ...	460 ...	19 ...	4·1
Guerry	1909 ...	280 ...	2 ..	0·7
Stanton	1910 ...	110 ...	5 ...	4·5
Deaver	1912 ...	374 ...	11 ...	2·9
Willis	1913 ...	401 ...	13 ...	3·2
Stanton	1914 ..	116 ...	8 ...	6·9
		1,741	58	3·3

TABLE III.—ANALYSIS OF 116 CASES OF ACUTE APPENDICITIS (STANTON).

	Treated	Operated	Died
Acute diffuse or gangrenous operated in during first forty-eight hours of attack	49	49	0
Acute cases with slight peritoneal symptoms operated in after forty-eight hours	18	18	0
Acute cases with well marked peritonitis operated in third to fifth day of attack	8	8	4
Cases seen after forty hours with well marked peritonitis. Ochsner treatment	22	20	2
Mild cases. Ochsner treatment only	2	0	0
Late cases with localized abscess at time of admission to hospital	16	16	1
Rupture of old undiagnosed appendicular abscess into general peritoneal cavity. Moribund on admission	1	1	1
	116	112	8 (6·9 per cent.)

TABLE IV.—GENERAL STATISTICS.

A.—Minningham. Compiled from American Hospital Reports:—

	Cases	Deaths	Per cent.
Total acute cases operated in	6,147	608	10·0
Acute cases without peritonitis	4,665	203	4·4
Acute cases with peritoneal lesions ...	1,582	405	25·6

B.—Albu and Rotter. Cases treated in Berlin Hospitals during 1907:—

	Cases	Deaths	Per cent.
Acute cases operated in	1,344	196	14·6
Acute cases not operated in	1,021	16	1·6
	2,365	212	9·0

(4) FREQUENCY OF TUBERCULOSIS OF THE APPENDIX.

In all the cases that were operated upon, careful search of the appendix was made to see if there was any tuberculosis present. Of the twenty-five cases that underwent operation well-defined tuberculosis of the appendix was found in five (20 per cent.). Two of these cases were in the moderately advanced and three in the far advanced stage of pulmonary tuberculosis. Tuberculosis of the appendix seems, there-

fore, to be present in the advanced stages of phthisis. None of the incipient cases showed evidence of tuberculosis in the appendix. Excluding the incipient cases, and combining the moderately advanced and advanced cases, there was a percentage of 26·3 which had tuberculosis of the appendix (nineteen cases, of which five had tuberculosis of the appendix). In some of these cases a probable diagnosis of intestinal tuberculosis was made previous to operation, but they all had symptoms of appendicitis prior to operation, and at operation all of them showed inflammation of the appendix, either simple inflammation or tuberculous. If one excludes the incipient cases, I am inclined to think that in the moderately advanced and advanced stages the percentage of cases with tuberculosis of the appendix is possibly higher than I have mentioned.

Primary tuberculosis of the appendix is believed to be very rare. In a few instances it has been met with. Like other forms of intestinal tuberculosis, tuberculosis of the appendix is usually secondary to tuberculosis of the lungs. It may occur independently of other involvement of the intestines, but is more commonly found in association with tuberculosis of the cæcum. Letulle states that in necropsies he has never found tuberculosis of the appendix without other lesions of the same nature in some other portion of the body.

Tuberculosis of the appendix seems to be more common in males (about 60 per cent.) than in females (40 per cent.) (*loc. cit.*). The age incidence in sixty-four cases collected by Muller was: 2 to 9 years, three cases; 10 to 19 years, eighteen cases; 20 to 29 years, twenty-one cases; 30 to 39 years, sixteen cases; 40 to 47 years, six cases.

My statistics are few, but for five patients with tuberculosis of the appendix three were males (60 per cent.) and two were females (40 per cent.). Three cases were between

20 and 30 years, one case between 30 and 40 years, and one case between 40 and 50 years.

In 3,055 operations for appendicitis from various sources fifty, or 1·6 per cent., were found tuberculous (Muller, from Keen's "System of Surgery," vol. vi, p. 571). These statistics correspond with those of Lockwood, who states that it is found in 2 per cent. of the operative cases (Osler's system).

(5) The Effect of the Operation.

One would think that these patients would not only stand operation badly, but that the shock of the operation and the irritation of the anæsthetic would have a bad effect on the disease in the lungs. First with regard to the danger of operation. There were twenty-five cases operated upon. No deaths occurred during the operation. These patients were in all stages of pulmonary tuberculosis, and their physical conditions varied. Most of them were in good physical condition. All were under climatic treatment, and this fact may have had some influence on the way they stood operation. Four cases with advanced pulmonary disease were in poor physical condition. All stood the operation well. I can say, therefore, that the immediate danger from operations is slight, and does not seem to be more than that which occurs with healthy persons.

Secondly, with regard to the after-effects of the operation upon the pulmonary disease and upon the general condition of the patient. Of the twenty-five cases operated upon there were two deaths within three days of the operation and one death within three months. One patient died of a septicæmia following a fulminating appendicitis, one patient died of probable delayed shock following a serious operation for removal of the appendix—cæcum, part of the ileum, and part

of the ascending colon, all of which were tuberculous; and the third patient failed rapidly after operation, and died within three months. No cutting was done in this case, as extensive disease of the appendix and bowels was found, and it was impossible to remove all the disease. This patient was failing rapidly previous to operation, and was a far advanced case in poor physical condition. In 12 per cent. of cases (three in twenty-five) there was a bad effect from operation. In twenty-two cases (88 per cent.) there was no bad effect, either on the general or lung condition. These patients stood the operation remarkably well, and within a short time were just as well as they were before operation. The operation seemed to have no ill-effect whatever on the lungs. Many of them showed a remarkable improvement and gained rapidly in weight. Of the five cases that had tuberculosis of the appendix, one is alive and well and at work, one died within a year of operation, one died four years after operation, one died three months after operation, and one died in three days after operation.

(6) Choice of an Anæsthetic.

When we employ a general anæsthetic, that one should be used which is safest and which will cause the least irritation to the lungs. Occasionally in my series of cases a local anæsthetic of adrenalin chloride and novocain was used and acted well. This can only be used on a limited number of cases, but if it can be used is to be preferred above all other anæsthetics, as it diminishes to a minimum the danger of shock, and causes no irritation to the lungs. It was used on two of my cases with complete satisfaction.

If local anæsthesia cannot be employed, the combination of nitrous oxide and oxygen is the anæsthetic of choice.

This was used on sixteen cases. One case died of probable delayed shock on the third day after operation. The appendix and cæcum and part of the ascending colon were removed on account of tuberculous disease. A second case grew rapidly worse after operation and died in three months. Here no cutting was done on account of extensive intestinal tuberculosis. In both cases the anæsthetic did not seem to cause any irritation to the lungs. In the remaining fourteen cases that took nitrous oxide and oxygen for anæsthesia there was no evidence whatever of any irritation to the lungs, and the lungs did not suffer in any way as a result of operation. Chloroform was given to three cases. One of these cases had a fulminating appendicitis and died on the third day after operation. The remaining two cases experienced no ill-effects on the lungs from this anæsthetic.

Ether was given to three cases, and all three experienced no ill-effects whatever on the lungs from this anæsthetic.

The prevailing opinion seems to be that ether should not be used on patients with pulmonary tuberculosis on account of its irritating the lungs. Chloroform is less irritating on the lungs than ether, but is more dangerous to the life of the patient. In the hands of a reliable anæsthetist it is to be preferred to ether on these cases. Nitrous oxide and oxygen is the anæsthetic of choice to be used on these cases. On my cases it proved to be satisfactory in every way, and there was no sign of irritation to the lungs. Dr. John B. Murphy (*loc. cit.*) suggests the use of spinal anæsthesia (*loc. cit.*) on cases of tuberculosis of the appendix, but I have had no experience of its use.

(7) The Question of Operation.

Here we have to consider the appendicitis in its acute form, and in its mild or chronic forms. In my cases, when

the appendicitis occurred acutely, there was a mortality of 12·5 per cent. (one death in eight operations for acute appendicitis). In 937 operations for acute appendicitis, Schnitzler had a mortality of 99 10·5 per cent. Of twenty-five patients of all classes of my cases—that is, acute, mild, and chronic appendicitis that were operated upon—there was a mortality of 8 per cent. (two deaths in twenty-five). Of 2,000 cases of all classes of appendicitis that were operated upon, Schnitzler had a mortality of 5·2 per cent. (104 deaths in 2,000 cases). It is seen that my percentage of mortality is slightly higher than that of Schnitzler. From careful observation of my tuberculous patients, not only during but after operation, I believe that these acute cases should be regarded as we regard apparently healthy patients, and that the lung condition should be excluded when we are making our decisions as to whether or not to operate. I think that this belief is justified from the facts that there were no deaths during operation, and that there were no bad effects on the lungs as a result of operation, and also because the mortality from operation was almost the same as on healthy persons. Patients with pulmonary tuberculosis stand the operation for appendicitis remarkably well. The above conclusion applies also to pulmonary cases in even a feeble condition. These patients also stood operation remarkably well.

When the appendicitis is mild or chronic I think the pulmonary condition should be considered. When mild or chronic attacks occur in patients in good physical condition we should choose a time for operation, which is most suitable. Such patients stand operation well, and should be treated as we treat healthy persons. Their lung condition should not be considered against the danger or detriment to their health from the appendicitis.

When mild or chronic attacks occur in patients in feeble

No.	Name	Age	Sex	Stage of the pulmonary tuberculosis	Description of the appendicitis attack	Operation or no operation	Result	Anæsthetic used	Condition of the appendix	Remarks
1	G. A. F.	28	Male	Moderately advanced case ; in good physical condition	Acute	Operation	Recovery	Novocain and nitrous oxide	No tuberculosis	
2	Mrs. W. H. S.	29	Female	Incipient case ; in good physical condition	,,	,,	,,	Nitrous oxide and oxygen	,,	
3	W. K. ...	42	Male	Moderately advanced ; in good physical condition	,,	,,	,,	Novocain and adrenalin (local anæsthetic)	,,	
4	H. A. F.	31	,,	Moderately advanced ; in good physical condition	Chronic	,,	,,	Nitrous oxide	Tuberculous	
5	H. C. ...	24	,,	Moderately advanced ; in good physical condition	Acute	,,	Death	Chloroform	No tuberculosis	
6	D. W. ...	23	,,	Incipient ; in good physical condition	Chronic	,,	Recovery	Nitrous oxide and oxygen	,,	
7	H. S. ...	30	,,	Moderately advanced ; in good physical condition	,,	,,	,,	,,	,,	
8	L. G. S.	26	,,	Moderately advanced ; in good physical condition	Acute	,,	,,	Ether	,,	Cæcal fistula developed, which afterwards healed
9	O. T. R.	45	,,	Moderately advanced ; in good physical condition	,,	,,	,,	,,	,,	
10	Mrs. F....	39	Female	Moderately advanced ; in good physical condition	Chronic	No operation	,,	—	—	
11	F. S. ...	33	,,	Moderately advanced ; in good physical condition	Acute	Operation	,,	Ether	No tuberculosis	

12	R. A. W.	27	Female	Moderately advanced; in good physical condition	Chronic	Operation	Recovery	Chloroform	Tuberculosis	
13	D. C. ...	19	Male	Incipient; in good physical condition	,,	,,	,,	Nitrous oxide and oxygen	No tuberculosis	
14	A. J. M.	25	,,	Moderately advanced; in good physical condition	,,	,,	,,	,,	,,	
15	H. S. ...	32	,,	Moderately advanced; in poor physical condition	Acute	,,	,,	,,	,,	A cæcal fistula developed after the operation
16	V. T. ...	22	,,	Advanced; in poor physical condition	Mild	No operation	—	—	—	
17	M. B. ...	32	Female	Far advanced; in poor physical condition	,,	,,	—	—	—	
18	A. N. ...	28	Male	Moderately advanced; in good physical condition	,,	,,	—	—	—	
19	A. W. P.	48	,,	Incipient; in good physical condition	,,	,,	—	—	—	
20	Mrs. W. R. R.	41	Female	Advanced; in good physical condition	,,	,,	—	—	—	
21	C. A. ...	23	,,	Moderately advanced; in good physical condition	Chronic	Operation	—	Nitrous oxide and oxygen	No tuberculosis	
22	B. H. ...	25	Male	Incipient; in good physical condition	Acute	,,	Recovery	,,	,,	
23	Mrs. S. M.	33	Female	Far advanced; in poor physical condition	Chronic	No operation	,,	—	—	
24	A. E. V.	29	Male	Moderately advanced; in good physical condition	,,	Operation	,,	Nitrous oxide and oxygen	No tuberculosis	
25	E. T. G.	34	,,	Moderately advanced; in good physical condition	,,	,,	,,	,,	,,	

No.	Name	Age	Sex	Stage of the pulmonary tuberculosis	Description of the appendicitis attack	Operation or no operation	Result	Anæsthetic used	Condition of the appendix	Remarks
26	R. L. ...	18	Male	Incipient; in good physical condition	Chronic	Operation	Recovery	Nitrous oxide and oxygen	No tuberculosis	
27	E. D. ...	37	Female	Moderately advanced; in good physical condition	,,	No operation	,,	—	—	
28	J. E. ...	28	Male	Moderately advanced; in fair physical condition	,,	,,	,,	—	—	
29	Mrs. D. A.	33	Female	Far advanced; in poor physical condition	,,	,,	,,	—	—	
30	E. W. ...	42	,,	Far advanced; in poor physical condition	,,	Operation	Death	Nitrous oxide and oxygen	Tuberculosis	
31	R. G. G.	20	Male	Moderately advanced; in good physical condition	,,	No operation	Recovery	—	—	
32	C. E. L.	33	,,	Far advanced; in fair physical condition	,,	Operation	,,	Nitrous oxide and oxygen	No tuberculosis	
33	E. D. ...	23	Female	Moderately advanced; in poor physical condition	,,	,,	,,	Local anæsthetic adrenalin chloride and novocain	,,	
34	H. A. F.	23	Male	Far advanced; in poor physical condition	,,	No operation	,,	—	—	
35	M. E. L.	36	Female	Moderately advanced	,,	,,	,,	—	—	
36	J. R. B.	32	Male	Incipient; in good physical condition	,,	Operation	,,	Chloroform	No tuberculosis	
37	C. G. G.	27	,,	Advanced; in fair physical condition	,,	,,	Death	Nitrous oxide	Tuberculosis	
38	S. M. ...	25	,,	Far advanced; in poor physical condition	,,	,,	Recovery	Nitrous oxide and oxygen	,,	

or poor physical condition, the question of operation should be decided only after careful consideration. Each case must be considered by itself. Such cases stand operation well. Should repeated attacks endanger their health or keep them from taking sufficient nourishment the appendix should be removed. I have seen remarkable improvement in such cases to follow operation. One patient (an advanced feeble case) gained in weight from 85 lb. to 135 lb. as a result of operation, a gain of 50 lb., and there was a corresponding improvement in her lung condition.

Case Histories.

Case 1.—G. A. F., male, aged 28. He was operated upon during the attack of acute appendicitis and made a complete and uneventful recovery. The operation had no ill-effects on his pulmonary tuberculosis nor on his general condition. He had occasionally suffered from pulmonary hæmorrhages previous to operation. The anæsthetic did not cause any sign of blood. He was in good physical condition, and was an arrested case of moderately advanced pulmonary tuberculosis. The operation was begun under local anæsthesia of novocain and adrenalin chloride. When the peritoneum was reached nitrous oxide was used.

Pathological report from the Royal Victoria Hospital, Montreal, Canada, February 20, 1912: Appendix. "The appendix measures 6 cm. in length and is very much enlarged. The mesentery is fatty and very thick. The lumen is patent throughout. The mucous membrane is markedly swollen and contains one or two ulcers. The other coats are thickened and congested; the external is covered with lymph. Microscopical examination: The section of the appendix shows that the lining layer is absent over the majority of the lumen. The glands are not numerous, and the inter-glandular tissue is much increased and infiltrated by inflammatory cells. The follicles are large and ill-defined. The submucous tissue and muscular tissues are infiltrated by inflammatory cells. The serous coat is thickened and very much infiltrated. The section of the surrounding tissue shows acute inflammatory

changes. No tuberculosis. Diagnosis: Acute diffuse appendicitis."

Case 2.—Mrs. W. H. S., female, aged 29. She was an incipient case of pulmonary tuberculosis in good physical condition, who was operated on during an acute attack of appendicitis. Nitrous oxide and oxygen were used for anæsthesia. There were no ill-effects on her general or lung condition as a result of the operation, and she made an uninterrupted recovery.

Surgeon's report from Montreal General Hospital, Montreal, Canada: "The appendix was large—3 in. long—much thickened, acutely inflamed (upon chronic, I should judge), introcæcally placed, very densely bound down by strong, thick adhesions and bands. The meso-appendix was unusually thickened. The outer and back part of the cæcum itself was thickened definitely. I could find no peritoneal tubercles."

Pathological report from the Montreal General Hospital, September 13, 1915: "Appendix 6·5 cm. long; serosal vessels markedly distended; fibrinous exudate considerable; mucosa markedly thickened. There were no gross evidences of tubercles or caseated areas; no perforations, ulcerations, or fæcoliths. Diagnosis: Chronic appendicitis."

Case 3.—W. K., male, aged 40. He was operated upon during his attack of acute appendicitis, and made a complete and uneventful recovery. He was a moderately advanced case of pulmonary tuberculosis, and was in good physical condition. Local anæsthesia of novocain and adrenalin chloride was used. The operation had no ill results on his general or lung condition. The appendix was found to be in an acutely inflamed condition. It had not ruptured. Careful search failed to find any evidence of tuberculosis.

Case 4.—H. A. F., male, aged 31. A moderately advanced case of pulmonary tuberculosis, who was operated upon for recurring attacks of appendicitis. He was in good physical condition. The operation had no ill-effects on his general or lung condition. Nitrous oxide was used for anæsthesia. He made an uninterrupted recovery. The operation was performed at the Royal Victoria Hospital at Montreal, Canada. The surgeon reported the following condition: "Examination of the appendix showed extensive

tuberculosis of the submucosa in the form of numerous tubercles. There was no ulceration, nor was there any involvement of the serous coat." This patient is now in good health and at full work.

Case 5.—H. C., male, aged 24. He was a moderately advanced case of pulmonary tuberculosis in good physical condition, and was operated upon during an acute attack of appendicitis. He gradually sank, and died within three days of the operation. Chloroform was used for anæsthesia. The appendix was fully $\frac{5}{8}$ in. in diameter and 2 in. long, and very dense. There was a spot of deep congestion about $\frac{1}{2}$ in. long in diameter and $\frac{1}{2}$ in. long. The appendix was adherent for about $2\frac{1}{2}$ in. There were 4 oz. to 5 oz. of sanguineous fluid in the peritoneal cavity. There was no odour to the fluid. The cæcum was deeply injected. The ileum was injected for 2 in. Examination of the surface of the bowels and appendix showed no miliary tubercles.

The operation lasted about seventeen minutes.

Case 6.—D. W., male, aged 23. He was operated upon for chronic appendicitis during the interval between attacks. He was an incipient case of pulmonary tuberculosis, and was in good physical condition. The operation had no ill results on his general or lung condition. He made a complete and uneventful recovery. Nitrous oxide and oxygen were used for anæsthesia. At operation the condition found was as follows: Appendix bound down by adhesions and kinked on itself. The small intestine was adherent to the cæcum. The appendix was 8 cm. long, was patent throughout, and appeared normal except for some few fibrous tags on the surface.

Diagnosis: Chronic appendicitis.

Case 7.—H. S., male, aged 30. He was operated upon for a chronic appendicitis, and made a complete and uneventful recovery. He was a moderately advanced case of pulmonary tuberculosis. The operation had no ill-effects on his general or lung condition. He was in good physical condition. Nitrous oxide and oxygen were used for anæsthesia. Pathological report from the Royal Victoria Hospital, Montreal, Canada: "An appendix measuring 5 cm. in length was received opened. The serosa was smooth and œdematous, but free from any evidence of tuberculosis.

The mucosa was swollen. The follicles were conspicuous throughout. The submucosal vessels were engorged, but there was no evidence of tuberculosis. Sections were taken from the central portion as well as the tip."

Case 8.—L. G. S., male, aged 25. He was operated upon during an acute attack of appendicitis, and made a complete recovery. A cæcal fistula occurred after operation but completely healed. The operation had no ill-effects on his general or lung condition. He was in good physical condition, and was a moderately advanced case. Ether was used for anæsthesia. The operation consisted of freeing of adhesions about intestines and drainage of appendix abscess. The appendix was not found.

Diagnosis: Chronic suppurative appendix abscess.

Case 9.—G. T. R., male, aged 44. He was operated upon during an acute attack of appendicitis and made a complete recovery. The operation had no ill-effects on his general or lung condition. He was a moderately advanced case and was in good physical condition. The appendix was acutely inflamed and adherent to the cæcum, and there was no evidence of tuberculosis in it.

Case 10.—Mrs. F., female, aged 39. She was a moderately advanced case, and had several mild attacks of appendicitis. No operation was performed. The attacks ceased, and she then remained well.

Case 11.—F. S. K., male, aged 33. He was operated upon during an acute attack of appendicitis. He was a moderately advanced case of pulmonary tuberculosis and was in good physical condition. He made a complete and uneventful recovery. The appendix was ruptured and gangrenous; the bowel was in good condition. There was no evidence of tuberculosis in appendix or bowel. Ether was used for anæsthesia. There were no ill results on his lungs or on his general condition as a result of the operation.

Case 12.—R. A. W., female, aged 26. She was operated upon during the intervals between attacks of a chronic appendicitis. She was a moderately advanced case of pulmonary tuberculosis in good physical condition. Chloroform was used for anæsthesia. There were no ill-effects from the operation on her pulmonary or general condition, and she

made an uninterrupted recovery. Pathological report from the Royal Victoria Hospital, Montreal, Canada, February 26, 1909: "The appendix is greatly thickened Microscopical examination: Sections show mucosa and submucosa present. The muscular and serous coats are greatly thickened by new granulation tissue, which contains many typical tubercles—that is, there are central giant cells, and around these a layer of endothelial cells, and outside this a layer of lymphocytes. No tubercle bacilli could be found, but it is undoubtedly a case of tuberculosis of the appendix." Macroscopically: "The appendix is greatly thickened and shows a subacute inflammation with adhesions, indicating old trouble. It is not near perforation."

Case 13.—D. C., male, aged 20. He was operated upon for a chronic appendicitis in the interval between attacks. He made a complete and uneventful recovery. He was an incipient case of pulmonary tuberculosis, and was in good physical condition. Nitrous oxide and oxygen were used for anæsthesia. There was no evidence of tuberculosis in the appendix. The operation had no ill-effects on his general or lung condition.

Case 14.—A. J. M., male, aged 25. He was operated upon for a chronic appendicitis in the interval between attacks. He made a complete and uneventful recovery. He was a moderately advanced case of pulmonary tuberculosis and was in good physical condition. The operation had no ill-effects on his general or lung condition. Pathological report: "There was no evidence of tuberculosis in the appendix. The appendix measured 6 cm. in length. The peritoneal coat was deeply congested. The wall was soft and thick. The submucosa was œdematous." Nitrous oxide and oxygen were used for anæsthesia.

Case 15.—H. S., male, aged 32. He was operated upon during an acute attack of appendicitis. He made a complete recovery. At operation a large abscess was found and a cæcal fistula developed later. He was in rather poor physical condition. There were no bad effects from the operation on his general or lung condition. There was no evidence of tuberculosis found in the appendix. Nitrous oxide and oxygen were used for anæsthesia.

Case 16.—V. T., male, aged 22. He was an advanced case of pulmonary tuberculosis, who had a mild attack of appendicitis, from which he recovered without operation.

Case 17.—M. B., female, aged 32. She was a far advanced case of pulmonary tuberculosis. She had a mild attack of appendicitis, from which she recovered without operation.

Case 18.—A. N., male, aged 28. He was a moderately advanced case of pulmonary tuberculosis, who had a mild attack of appendicitis, from which he recovered without operation.

Case 19.—A. W. P., male, aged 48. He was an incipient case of pulmonary tuberculosis, who had a mild attack of appendicitis, from which he recovered without operation.

Case 20.—Mrs. W. R. R., female, aged 41. She was a far advanced case of pulmonary tuberculosis, who had a mild attack of appendicitis, from which she recovered without operation.

Case 21.—C. A., female, aged 23. She was a moderately advanced case of pulmonary tuberculosis in good physical condition, who was operated upon in the interim between attacks. Nitrous oxide and oxygen were used for anæsthesia. She made a complete and uneventful recovery. The operation had no ill-effects on her general or lung condition.

Pathological report from the Royal Victoria Hospital, Montreal, Canada: "The appendix measures 8 cm. in length. The diameter is somewhat enlarged. The lumen is patent throughout. The mucous membrane is swollen and ulcerated in one or two places. The muscular coats are normal. The serous coat is congested. Diagnosis: Acute ulcerative appendicitis."

Case 22.—Dr. B. H., male, aged 25. He was an incipient case of pulmonary tuberculosis in good physical condition, who was operated upon during an acute attack of appendicitis. Nitrous oxide and oxygen were used for anæsthesia. He made an uninterrupted and complete recovery. The operation had no ill-effects on his lung or general condition.

Pathological report from the Royal Victoria Hospital, Montreal, Canada: "An appendix 7·5 cm. in length was

received. The serous coat was thickened and congested. The walls were thickened. The mucous membrane was coarsely granular. Microscopical examination: Section shows an acute interstitial appendicitis. Surface epithelium almost gone. Glands few; large, well-preserved epithelium. Interglandular tissue abundant; dense inflammatory cell infiltration, among which many polynuclears are noticeable. There are a few areas of fibrosis. The lymph follicles are large—numerous lymphoid elements. Submucosa, rich in fibrous tissue, shows inflammatory cell infiltration. Muscular fibres separated by œdema, in which many polynuclears are to be seen. Serosa thickened; inflammatory cell infiltration. Diagnosis: Acute interstitial appendicitis."

Case 23.—Mrs. T. M., aged 33. She was a far advanced case of pulmonary tuberculosis, who had a mild attack of appendicitis, from which she recovered without operation.

Case 24. A. E. Y., male, aged 29. He was a moderately advanced case of pulmonary tuberculosis in good physical condition, who was operated upon in the interval between attacks. He made a complete and uneventful recovery. Nitrous oxide and oxygen were used for anæsthesia. The operation had no ill-effects on his general or lung condition.

Pathological report from the Royal Victoria Hospital, Montreal, Canada: "An appendix 5 cm. in length was received opened. The serous coat was smooth and pale. The mucous lining was slightly congested. Microscopical examination: The columnar epithelium is slightly desquamated. The tubular glands are few in number, ill-formed, only the fundi of some being present. The interglandular tissue shows slight fibrosis, and is infiltrated with lymphocytes. The lymph follicles are few, large, well-defined; lymphoid cells preponderate. The submucosa is slightly thickened, and shows slight fibrosis and scattered diffuse inflammatory cell infiltration. The muscularis is œdematous and shows slight fibrosis. Diagnosis: Interstitial appendicitis."

Case 25.—E. T. G., male, aged 34. He was a moderately advanced case of pulmonary tuberculosis in good physical condition, who was operated upon in the interval between the attacks of appendicitis. His recovery was complete and uneventful, and the operation had no ill-effects on his general

or lung condition. Nitrous oxide and oxygen were used for anæsthesia.

Pathological report (from New York Post Graduate Hospital and College):—

Gross: Appendix, 9 cm. in length, split open lengthwise. Coats are thickened, especially the peritoneum, which is also injected and presents a stripped appearance (adhesions?). The mucosa is dark red and moderately redundant.

Microscopic: Peritoneal vessels engorged with blood, as are also the vessels of the other coats, especially the mucosa. The peritoneum is moderately thickened, and shows scattered foci of round-cell infiltration, especially in the neighbourhood of the vessels. The muscular and submucous coats are also thickened and moderately infiltrated with round cells.

Diagnosis: Chronic appendicitis.

Case 26.—B. L., male, aged 17. He was an incipient case of pulmonary tuberculosis in good physical condition, who was operated upon in the interval between the attacks of appendicitis. His recovery was complete and uneventful. The anæsthetic was nitrous oxide and oxygen. The operation had no ill-effects on his general or lung condition. No evidence of tuberculosis was seen in the appendix.

Case 27.—E. D., female, aged 37. She was a moderately advanced case of pulmonary tuberculosis in good physical condition, who had mild attacks of appendicitis, from which she recovered without operation.

Case 28.—J. C., male, aged 29.—A moderately advanced case of pulmonary tuberculosis in fair physical condition, who had several mild attacks of appendicitis, from which he recovered without operation.

Case 29.—Mrs. D. A., aged 33. A far advanced case of pulmonary tuberculosis in poor physical condition, who had a mild attack of appendicitis, from which she recovered without operation.

Case 30.—E. W., female, aged 42. A moderately advanced case of pulmonary tuberculosis in poor physical condition, who was operated upon during the interval between attacks of appendicitis. Nitrous oxide and oxygen were used for anæsthesia. She failed rapidly after the operation, and died within four months.

Surgeon's report from the Royal Victoria Hospital, Montreal, Canada: "The diagnosis of cæcal tuberculosis was correct, but I am sorry to say she had also extensive disease of the small bowel. I explored the lower 4 ft. or 5 ft. of the ileum and found ulcers showing through on the peritoneal surface, and growing more numerous as one went up the bowel. I then fished out a coil of small bowel in the jejunum and found more ulcers. It was clear that the disease was too extensive to do anything with. The cæcum was involved for about 2 in. from its base. The wall was thick, œdematous, and covered in spots with a fibrous exudate. The appendix was about twice its normal size, and in the same condition as the cæcum. There were no adhesions, and it would have been an easy matter to resect the whole thing. I was greatly disappointed with the coincidence of small bowel tuberculosis."

No cutting was done, and the abdomen was closed.

Case 31.—R. G., male, aged 20. He was a moderately advanced case of pulmonary tuberculosis in good physical condition, who had a mild attack of appendicitis, from which he recovered without operation.

Case 32.—C. E. L., male, aged 33. He was a far advanced case of pulmonary tuberculosis, who was operated upon for appendicitis during the interval between the attacks. He was in fair physical condition. There were no ill-effects on his general or lung condition from the operation, and he improved in every respect and gained in weight. Nitrous oxide and oxygen were used for anæsthesia. At a later date he underwent a second operation for tuberculosis of the bowel.

Surgeon's report from the Royal Victoria Hospital, Montreal, Canada: "I operated on L., and found as we had suspected—tuberculosis. It involved, however, chiefly the cæcum. The appendix was congested, but I could find no definite tuberculous lesion in it. The wall of the cæcum was quite thickened and œdematous for about 2 in. up from the appendix, but was normal beyond. I examined carefully the last foot and a half of the ileum, and thought I found a slightly thickened area about 10 in. from the valve suggestive of a mucosal ulcer."

Pathological Report.—Royal Victoria Hospital, Pathological Department: "Appendix: An appendix was received

measuring 7 cm. in length and 0·8 cm. in diameter. There is no exudate on the surface. On section the wall shows fibrous thickening in some places. The mucous membrane shows small areas of ulceration.

"*Microscopical Examination:* The lumen of the organ is empty. The glandular lining is absent. The lymph follicles are poorly defined. The submucosa is thickened, œdematous, contains loose connective tissue, and slight inflammatory exudate of lymphocytes. The muscular coat is normal. The serous coat is thickened and shows slight fibrosis. No giant cells or evidence of tuberculous formation is seen.

Diagnosis: Chronic appendicitis; not tuberculous."

Case 33.—E. D., female, aged 23. She was a moderately advanced case of pulmonary tuberculosis, who was operated upon for chronic appendicitis. She was in poor physical condition. There were no ill-effects on her general or lung condition from the operation, and she afterwards gained 50 lb. She was operated upon under local anæsthesia—novocain and adrenalin chloride.

The following is the surgeon's report: "Appendix was congested and reddened with thickened mesentery; readily removed; stump buried by circular purse-string.

"Pelvic examination revealed distinct evidences of granular bodies on the surface of the uterus and broad ligaments, but no enlargement of tubes or ovaries could be made out; no tubercles could be seen on exposed cæcum, ileum, or parietal peritoneum."

Pathological Report: "An appendix 8 cm. in length was received. It is reddened somewhat. There is no exudate on the surface. The lumen contains mucinous matter. Microlumen contains cell detritus. The blood-vessels of the submucosa are congested. There is definite lymphatic infiltration into the serous coat of the appendix."

Pathological Diagnosis: "Chronic appendicitis."

Case 34.—H. A. F., male, aged 23. He was a far advanced case of pulmonary tuberculosis, who had a mild attack of appendicitis, from which he recovered without operation.

Case 35.—M. F. L., female, aged 36. She was a moderately advanced case of pulmonary tuberculosis, who

had a mild attack of appendicitis, from which she recovered without operation.

Case 36.—J. R. B., male, aged 30. He was an incipient case of pulmonary tuberculosis, who was operated upon during the interval between the attacks of appendicitis. There were no ill-effects on his general or lung condition from the operation, and he made an uninterrupted recovery. Chloroform was used for anæsthesia.

Pathological Report: "The appendix was markedly constricted near the base to a fibroid cord with the lumen obliterated for one quarter of an inch, and beyond this to the tip it was in a cystic state, but sterile as to contents. In the lumen there was a marked degree of catarrh of the mucosa and peritoneal coats, and small petechial hæmorrhage in one cyst. The organ was bent upon itself, and adherent to the inner side of the cæcum by old adhesions. Sections failed to show any signs of tuberculosis, and the pathological diagnosis was chronic appendicitis."

Case 37.—C. G. G., male, aged 27. An advanced case of pulmonary tuberculosis in good physical condition. He was operated upon during the interval between attacks of appendicitis. The operation was begun under local anæsthesia. Nitrous oxide was used as the operation progressed. The following is the surgeon's report from the Royal Victoria Hospital, Montreal, July 2, 1915:—

"Operation this afternoon on Mr. G. showed he had tuberculosis of the cæcum and ascending colon. The appendix was buried in adhesions. It was uniform in contour. I removed the last few inches of the ileum with the valve, cæcum, and ascending colon as far as the hepatic flexure. An anastomosis between the ileum and the transverse colon completed the operation. I did the abdominal incision and resection of the ileum under local anæsthesia, but used gas for the colotomy. He bore the operation well, and was in good condition after its close."

Letter from the surgeon, July 7: "I feel very much disappointed in having to report the comparatively sudden death of Mr. G. (July 5). I saw him late on Sunday night about 11 o'clock (*i.e.*, two days after operation). He was then troubled, as he had been on and off for two days with hiccough and the regurgitation of clear water, occasionally

bile-stained. His temperature was normal; his pulse had increased somewhat in rate. He had absolutely no pain, his abdomen was neither tense nor distended, nor was there the slightest rigidity; in fact, I looked upon the case as making a good convalescence. On Monday morning (three days after operation) he developed a train of symptoms which were regarded as being due to those of delayed shock, characterized by gradual but steady increase in the rapidity of the heart's action with an increasing weakness, evidently those of vasomotor influences."

Microscopical report from the Royal Victoria Hospital, Montreal, July 3, 1915:—

"Tuberculosis of the cæcum. Cæcum: specimen consists of 4 in. of cæcum, 2½ in. of ileum, and the appendix. The mucous membrane is swollen and thick.

"Microscopical examination: The appendix shows in the submucous and mucous layer, marked and diffuse thickening by fibrous tissue, lymphoid infiltration, and the general features of a granulous infiltration. Although these are not specific, it may be assumed on the strength of the lesions in other parts of the gut that they may be attributed to the same cause.

"Macroscopically the marked feature was massive infiltration of the cæcum, particularly the caput. The peritoneal surface was very œdematous."

Case 38.—S. M., male, aged 26. A far advanced case of pulmonary tuberculosis, who had had repeated mild attacks which simulated disease of the appendix. He was in poor physical condition. Nitrous oxide and oxygen were used for anæsthesia. There were no ill-effects on his general condition or on his lungs as a result of the operation, and he recovered well from the operation. Operation: October 10, 1914.

Pathological report from the Royal Victoria Hospital, Montreal, Canada: *Cæcum:* Specimen consists of a portion of lower end of ileum measuring 7 cm. in length, and a portion of cæcum and ascending colon measuring 15 cm. in length. The wall of the cæcum is thickened. In many places the mucous membrane shows diffuse areas of ulceration, showing undermined edges and a ragged base. The largest of these areas measures about 5 cm. in length. They run roughly parallel to the circumference of the bowel. The

retrocæcal lymph nodes are enlarged and firm. On section they are congested, and show small white spots throughout their substance.

Microscopical Examination: The mucous membrane of the bowel shows marked congestion. The submucosa and muscular coats are œdematous, congested, and show some infiltration with inflammatory cells. In the muscular layer is seen a definite tubercle showing early giant-cell formation. The serous coat is thickened and vascular, and shows inflammatory cell infiltration. Section of retrocæcal lymph node also shows definite areas of tubercle formation. The lymph node shows marked congestion.

Diagnosis: Tuberculosis of cæcum and involvement of retrocæcal lymph nodes.

Surgeon's Report.

"In addition to the above, I might give a few details of my own examination of the gross specimen. The wall of the cæcum was markedly thickened by diffuse chronic œdema and infiltration. The mucosa was also somewhat hypertrophied so as to present a flat cauliflower appearance, particularly in the neighbourhood of the ulcers. These were numerous, and extended up to pretty near the point at which I cut through the ascending colon and immediately below the hepatic flexure. The bowel up here was normal to the feel before it was opened. I think I am well above the disease, but the finding of an ulcer this far up in the ascending colon is a warning to go farther and resect the transverse colon.

"The surface of the cæcum and ascending colon was covered with a thin organized vascular membrane—a Jackson's membrane such as we see in some cases of chronic appendicitis. This is a further point against considering the membrane as a congenital affair, or one merely the result of pulling.

"The disease affected the appendix also to a marked degree. It contained two fæcal concretions, but in addition was diffusely thickened in all its coats, and was adherent to base of cæcum, and the mucosa showed three rather large ulcers, involving most of its length. I feel sure the appendix is rarely involved alone. Nowhere does the ulceration extend materially below the submucosa, although the inflammatory thickening of its base goes through to the peritoneum."

DISCUSSION.

Dr. MINOR: There is one indication for operation in the chronic case which I am sure you will agree is important—that is, a bad diarrhœa. Even when the appendicitis is of the very mildest form I think operation is indicated. I have again and again observed the beneficial effects of operation in these cases. I should like to say a word regarding the anæsthetic—regarding the use of ether. Of course, the patient is more quiet under ether, and I have great difficulty in making the surgeon—who thinks chiefly of the greatest ease of operation—realize that there is any contra-indication for its use. But I have seen so many bad results from ether—rapid dissemination, and even fatal effects—that I do feel that it is contra-indicated. I recently read a pamphlet written by a doctor in Colorado Springs, in which he said he had found that ether by the drop method was perfectly satisfactory, but that ether by the ordinary method did give trouble. If this is true it will be of great benefit, because, of course, ether is a beautiful anæsthetic for the surgeon.

Dr. EDSON: I was much interested in Dr. Kinghorn's paper, because it is a subject which comes within the experience of all of us, and which in the past has given us no little anxiety. There is no question as to what should be done with acute or fulminant appendicitis. Such an appendix must be taken out, no matter what the underlying condition of the patient may be. The cases which are of greatest importance are those of chronic recurring appendicitis, and especially those of chronic progressing appendicitis. These latter, frequently without the occurrence of any acute attack, give rise to a chronic indigestion and malnutrition which is often treated over a long period as simple indigestion without the true cause being recognized. It has been increasingly my experience that these cases, in which the indigestion is impairing the welfare of the patient, should be subjected to appendectomy. It is only in stages of advanced pulmonary disease where it is only a question of a short duration of life that they can be neglected. Regarding operation, Dr. Minor has said that it is reported that ether by the drop method causes no bad effects, but that ether by the ordinary method does. I wish to take exception to this remark. The only proper way to give ether is by the drop method. When so given I have never seen trouble follow. All my patients who have been operated on have been given ether always by the drop method, with abundance of air. Only in one case could I trace any harm done to the pulmonary condition. It was in increase in the area of involvement, or permanent lighting up of the tubercular process in the lung. In that one case the patient developed an acute broncho-pneumonia during an epidemic of influenza which was prevailing in the hospital at the time. This he developed a week after the operation, and I am inclined to attribute it to the epidemic rather

than to the anæsthetic. I am willing, however, to lay it to the charge of the anæsthetic, and say that I have had one case in which permanent harm apparently resulted from ether. This, however, is the only instance.

Dr. BABCOCK: Since there is this question in regard to the advisability of ether anæsthesia, why not consider local anæsthesia? It is being used very extensively, and I think that experience has shown that appendectomies are ordinarily very easily performed under local anæsthesia. If there is any likelihood of pain, just as the surgeon enters the peritoneal cavity after having performed all the skin work a little gas and oxygen can be administered; and certainly there can be no question under these circumstances of any ill-effect upon the pulmonary condition. This is the plan which I am advocating in cases of appendicitis in patients with cardiac disease; and I should like to say also that when in the case of an individual who requires a peritoneal operation there is any question of the effect on the heart I use the re-breathing method of administration. In such a case the anæsthesia may be very complete, oftentimes with no ether whatsoever, or only an infinitesimal amount. I can heartily recommend both of these methods local anæsthesia and the re-breathing method.

Dr. HOLDEN: During the last twelve years I have had quite a number of cases of appendicitis. In these operations I prefer ether to any other anæsthetic—ether by the drop method. I should like to say, further, that in the advanced cases I do not permit the patient to be operated upon unless he is thoroughly prepared and the surgeon is ready before the anæsthetic is given. I have also recently had two cases in which local anæsthesia, which Dr. Babcock has referred to, was used. These were rather advanced cases, and the local anæsthesia worked perfectly.

Dr. PERKINS: Dr. Kinghorn spoke of the necessity of examining patients with evidences of indigestion to determine whether appendicitis is the cause of the indigestion. I would go a step further and would say examine for appendicitis all patients whom you think have tuberculosis but who are without definite signs. More than once I have had a patient come to me with a suspicion of tuberculosis, where sending him to a surgeon, who has operated for appendicitis, has cleared up the signs of tuberculosis. I have a case in mind—a case not under my immediate observation. This man had gone to Saranac Lake. At the time he ran a slightly irregular temperature, he had some definite symptoms assigned to the right apex, and an X-ray plate gave a shadow in that locality. He came back from Saranac, but continued to run the same irregular temperature, supposed to be tuberculosis. He then developed definite signs of appendicitis and was operated upon, with disappearance of the pulmonary signs.

Dr. C. F. GARDINER: I would like to substantiate what Dr. Edson said. I have practised for thirty years in Colorado, and during that

time have had many hundreds of tubercular patients take ether. Years ago we were using the older methods and possibly then we did observe some irritation of the lungs following. Of later years, however, when the ether has been given expertly by the drop method and the cases selected with as much care as possible, we have not been able to observe the disastrous effects in augmenting tubercular trouble so frequently mentioned in the text-books and by members of this Society. In fact, during the past year we had a symposium prepared upon this subject for the Solly Tuberculosis Society, and the discussion, I think, amply brought out the fact that in several hundreds of patients who had received ether and who were suffering at that time with pulmonary tuberculosis, an increase in the symptoms, except in bronchitis, was very rarely observed, so rarely as not to be a factor in the ordinary risk taken. I, personally, cannot remember a case that I can definitely say was injured by an ether anæsthesia during the last ten years, and this, I find, is substantiated by the anæsthetists that have given ether to my cases.

Dr. ELLIOTT: I have in mind three cases of chronic appendicitis whose symptoms simulated tuberculosis. These patients had a slight evening fever, and a diagnosis of pulmonary tuberculosis was made. The physical signs were those of an incipient tuberculosis, but did not seem sufficient to account for the suffering and the slight evening temperature of 99·5. These were really cases of chronic appendicitis. Two of the patients were operated upon, with complete relief of the condition; the third refused operation, and still has the signs of incipient pulmonary tuberculosis, though it is quite clear that the condition is one of chronic appendicitis.

Dr. BONNEY: I first desire to utter a word of commendation as to the very sane and practical manner in which Dr. Kinghorn has treated this subject; and secondly, since there seems to be a difference of opinion in regard to the use of ether in operations upon consumptives in Colorado, I wish to relate my own experience in its use by the drop method in that state. In appendicitis of acute type among pulmonary invalids I have usually experienced but little difficulty in securing the consent of patient and family to immediate operation. When, however, the pulmonary condition is considerably advanced, surgeons as a rule have been more or less reluctant to assume the responsibility of such operation. Under these conditions the employment of ether by the drop method has been the usual procedure. In cases of chronic appendicitis among consumptives there has been, as a rule, considerable difficulty in influencing the patient to submit to operation, notwithstanding the history of repeated attacks and persisting digestive disturbance. In many cases the patient and family have demanded a definite assurance that there will be no unfortunate developments following the ether anæsthesia. I have never had occasion to regret immediate operation in acute appendicitis even

among pulmonary invalids. In some cases it may be a choice of the lesser of two evils, but I have always felt justified in giving the invalid the benefit of the same consideration that would be due to the non-consumptive under similar conditions. In chronic cases, however, the same exigency does not exist, notwithstanding the fact that the diagnosis may be fully demonstrated by the use of the X-ray. While I have observed no fatalities as a result of the operation, I have nevertheless, in quite a number of cases, had abundant reason to regret the ether anæsthesia. In some cases it has been months before I could conscientiously report to the patient and family that the pulmonary condition was at all comparable to what it was before the operation.

Dr. BROWN: I should like to ask Dr. Bonney to say something about a side of this question that Dr. Kinghorn passed over rather quickly and in which I know he has had considerable experience—that is, the operation for tuberculous enteritis. Personally I have had three cases, but no very definite conclusions can be drawn from three cases. Following Dr. . . . of all mankind into two types, carnivorous and herbivorous, I found that the carnivorous type did very badly, and the herbivorous type much better. I might add that all of them died. The interesting point of difference in these two types is the length of the intestinal tract. In the carnivora the intestinal tract is only 10 to 15 ft. long, or possibly less; whereas in the herbivora the canal is very much longer—it may run to 20 or 30 ft. And if you remove some of the intestinal tract you will get a very different remaining condition. I might say, also, that I have been going over some recent notes of sixteen or seventeen cases of appendicitis, and my results have not been as favourable as Dr. Kinghorn's. Three did not come to operation and did very well. Thirteen were operated upon. Of the operative cases six had perforation; of these four did well, but two died before leaving the hospital. One died; one developed a hernia; one had been operated on for spontaneous pneumothorax and did remarkably well; two developed fistulæ, which yielded to a secondary operation.

Dr. WILL HOWARD SWAN (Colorado Springs): I can agree with Dr. Edson in regard to the use of ether in these operations. I recall one case that went wrong after ether anæsthesia, with considerable trouble afterwards; but if one were inclined to study the condition very carefully it would be only fair to say that this was a patient who had had repeated flarings-up in his chest. I think this is the only case in which I should have any idea at all that ether had been harmful. I also agree with Dr. Edson that the proper method of administration of ether is by the drop method. I believe, however, that nitrous oxide with oxygen is the better anæsthetic for most cases of tuberculosis. I have never seen any harm result from its use. I have recently had a case of advanced tuberculosis, in which an artificial pneumothorax had been performed three or four days before an

acute attack of appendicitis, and it is interesting to note that the patient experienced no difficulty from the anæsthetic. I think this is one of the most important subjects that can be brought before us, who look after a good many cases of tuberculosis—not so much with regard to the acute cases as to those patients who begin to digest poorly, who perhaps, as Dr. Kinghorn has said, have very indefinite symptoms of poor digestion, the cause of which we do not know. The making of a thorough routine examination of the abdomen in all cases will very often help us in getting rid of these obscure indigestions. I think that many of them are due to appendicitis; but I think, too, that many are due not so much to appendicitis as to a coincident mechanical difficulty in the locality of the appendix. I am inclined to think that many of these cases are adhesion affairs and are often relieved by operation; and I have felt many times that perhaps the relief of the mechanical difficulty was quite as much a factor in the improvement as the relief of the appendicitis itself. It can be said, however, that occasionally patients who have had repeated attacks of appendicitis and refuse operation do get relief for a very long time. I have in mind a woman who, about three years ago, had very poor digestion, the cause of which was uncertain. She finally had a definite attack of appendicitis and operation was advised, but was refused. Her digestion now is very good, and she is very gleeful because she has cheated the doctors out of an operation.

Dr. PATERSON: I should like to say a word in regard to tuberculosis of the appendix itself. Tuberculosis of the cæcum, of the lower end of the ileum, and of the appendix is usually very insidious in its onset. Dr. Kinghorn has said that in about 20 to 25 per cent. of cases operated on for appendicitis a tuberculous condition has been found. In such cases, if operation is performed early before the disease has progressed far, it may be possible to remove the trouble completely or to do a short circuit, which would give physiological rest to the diseased portion and thus more chance of healing. I have had one patient who was found to have extensive tuberculosis of the lower end of the ileum, the appendix, and the cæcum. This condition was found at an operation for a rather doubtful diagnosis of appendicitis, the chief symptoms being abdominal discomfort, slight fever, and constipation. Complete removal of the disease was out of the question, and a short circuit was done with most gratifying results. In the discussion regarding the anæsthetic for operations on patients with pulmonary disease, the intraspinous use of novocain or stovain was not mentioned. I have seen this used several times, but have always been afraid of it owing to the depression during and after the operation.

Dr. PHILLIPS: It seems to me that the administration of ether in Colorado, or at high altitudes, and its administration at relatively low altitudes like Asheville, is followed by very different results, and

therefore I would suggest that it is really a climatological question. Asheville is 2,000 ft. above sea-level, compared with Colorado, which is 6,000 ft. Whilst the law that gases are to each other as a vacuum—that is, that the presence of one gas in a space does not prevent the presence of an equal volume of another gas in the same space and at the same instant—holds true, it is only true if the element of time be ignored. Every one that has experimented with gases knows that the element of time must be considered in all experiments or conditions involving the passage of one gas into a space in which either a different gas or even the same gas already exists. In other words, it takes time for a gas to diffuse itself between the molecular interspaces of another gas. Now, the denser the other gas is, or the greater its pressure, the longer time it will take for diffusion to complete itself. Here, then, is perhaps the solution of the present problem—the difference with which the ether is removed from the system in the two localities, or, in general terms, the difference between ether elimination at sea-level and moderate altitudes and at relatively high to high altitudes. The average atmospheric pressure at Asheville, N.C., is 24·71 in., while at Denver, Colorado, it is 24·74, or the atmospheric pressure at Asheville is 92 per cent. of that at sea-level, while that at Denver is but 82 per cent. of that at sea-level. Perhaps it is this diminution of atmospheric pressure that facilitates a more rapid systematic elimination of the ether in the higher altitudes of Colorado, with a resulting favourable difference in its physiological effects. Why not see if, after all, it be not a real climatological effect—not a difference due to differences in clinical technique and clinical opinion?

Dr. MINOR: Since my Colorado friends attack my position I should like to say a word further. I am not at all ready to admit that the drop method is the only method to be used. I said, however, that perhaps the drop method was all right. If the Colorado men, in their wonderful atmosphere, have gotten such good results with it I am delighted; but I myself have seen very bad results from ether in these cases.

Dr. KINGHORN: There is really nothing more for me to say, except with regard to the anæsthetic. In a number of my cases local anæsthesia has been used. Some of these cases were very feeble, and the local anæsthetic of novocain and adrenalin chloride worked very satisfactorily.

SOME FEATURES IN THE CONTROL OF TYPHOID FEVER.

By LINSLY R. WILLIAMS, M.D.
ALBANY, N.Y.

Typhoid fever, as it has been recognized since the days of Louis, has been a blot on civilization. Sanitarians and physicians speak of typhoid fever as a water-borne, milk-borne, or fly-borne disease, but neither water, milk, nor the much abused fly is the cause of typhoid fever. Its cause is well known, the *Bacillus typhosus* or Eberth's bacillus, and by always recognizing the fact that the normal habitat of this bacillus is the human intestinal canal and in some other mucous membranes of the abdominal cavity, one can easily point out the true method for the control of typhoid fever.

The method is simple, theoretically at least, and may be stated in six words: *the sanitary disposal of human excreta.* Practically, however, it is not a simple matter, or the problem would not be one of such surprising magnitude. If typhoid fever were as fatal as cancer, it would take the place of tuberculosis as the captain of the men of death, or if as fatal as pneumonia, it would be a close third to pneumonia and tuberculosis as a cause of death in the United States.

Typhoid varies in extent in the different parts of this

country, and has always been more prevalent in the warmer sections of the south. It has varied also with the sanitary manner in which the inhabitants live in any given district.

It is more prevalent in the United States than in Europe, and more prevalent in cities of the United States than in cities in Europe. Up to 1910 the typhoid death-rate in the United States was a little more than 45 per 100,000 living inhabitants, and the highest European rate was 35 for Italy, Germany being 7·6, and Scotland 6·2. In the large cities of the United States the rates have varied from 7 to 10 in Cambridge; Jersey City and Paterson to 22; and 24 in Philadelphia and Pittsburg, to 50 and more in Atlanta and Birmingham; while, on the other hand, Munich, Edinburgh, and London have rates from 2 to 5. There are good and sufficient reasons, no doubt, for the high rates, but the reasons for the exceedingly low rates in the European cities is not readily given. Purity of water supply, sanitary disposal of sewage, general cleanliness, and sanitary control of disease is as good in some of our cities as in many foreign cities, yet the rate in our cities is four or five times greater than in the foreign. No satisfactory answer can yet be given for these divergent rates.

In the State of New York the mortality from typhoid has for years been considerably lower than that for the rest of the country taken as a whole. Mortality statistics have been fairly accurately kept in New York State since 1885, and from that date until 1910 there were annually about 1,600 deaths. The mortality did not increase with the increase in population, and consequently a steady decrease in the rate is noted (see Table I).

Prior to twenty years ago typhoid was generally believed to be water-borne, but sanitarians and a few advanced physicians realized its communicability, and treated it as such.

TABLE I.—TYPHOID FEVER; NEW YORK STATE (OUTSIDE OF NEW YORK CITY).

Year	Population	Cases	Deaths	Per 100,000	
				Case rate	Death rate
1908	4,253,286	3,811	837	90	20
1909	4,305,441	4,284	751	100	17
1910	4,357,597	4,801	816	110	19
1911	4,414,182	4 426	771	100	17
1912	4,480,767	3,343	629	75	14
1913	4,527,353	3,605	656	80	14
1914	4 583,938	3,221	544	70	12
1915	4,640,523	3,028	417	65	9

Efforts to control typhoid fever were, therefore, pretty uniformly limited to steps taken to improve the source of water supply or to purify the water by filtration. This, at the time, seemed the logical thing to do, but many cities suffered from severe typhoid epidemics with unnecessary financial loss and almost countless fatalities before the fiscal authorities in many of these places became convinced of the necessity of installing filtration plants. There is one city in New York State that now has an excellent filtration plant, but two severe water-borne epidemics were necessary to produce the public sentiment needed to secure a safe water supply. In a recent publication of *Health News*, the official monthly bulletin of the New York State Department of Health, there is an article prepared by the Chief Engineer of the Department, and a table prepared by his principal assistants (Horton and Cleveland) which cites many important data on the subject of water supply and typhoid fever in the fifty-seven cities of the State.

From a study of this table it will be seen, first, that of the fifty-seven cities listed in the table the water supplies of some forty-three have been improved in recent years, either through the introduction of purification methods, or through the enforcement of rules and regulations established by the State Department of Health or other means of sanitary patrol, or through the abandonment of polluted supplies and the introduction of new and purer ones.

Considering the table in more detail with reference to the nature and extent to which these purification processes have been introduced in these cities, it will be seen that eighteen of the fifty-seven cities purify their entire public water supplies by filtration, and three others so purify a portion of their supplies. Of the twenty-one cities which in part or in whole so filter their supplies, some nine filter them by slow sand filters, and twelve by mechanical filters of either the gravity or pressure type. Furthermore, of these twenty-one cities which so purify their water supplies by filtration, some fourteen of them further purify them by means of chlorination.

Again, it will be seen that in addition to the twenty-one cities referred to whose supplies are purified by filtration alone or with supplementary chlorination, fifteen other cities purify their supplies by chlorination alone, thus making a total of some thirty-six of the fifty-seven cities of the State, or approximately two-thirds of them which purify their supplies either by filtration or chlorination, or both. These thirty-six cities represent a combined population of about 6,890,000 persons, or 89·3 per cent. of the population in the cities of the State. It should be remembered, of course, that this table refers only to the cities of the State, whereas, if the entire population of the State were considered, this percentage would undoubtedly be somewhat lower.

The improvement in the water supplies of the State generally has had a marked effect in lowering the typhoid fever death-rates, so that during the past two years a considerably greater amount of time and efforts have been given by the Department, through its engineering division and with the co-operation of the sanitary supervisors, in this particular field. It must be obvious to anyone familiar with this subject that the difficulty of lowering the typhoid fever death-rate is greater as this rate declines. It is significant,

TABLE II.—WATER SUPPLY AND TYPHOID FEVER IN THE CITIES OF NEW YORK STATE.

City and Population (State Census of 1915)	Source of water supply	Present treatment	Remarks	Typhoid Fever Death-rates (Average annual deaths per 100,000 population)				
				Before improvement in water supply	After improvement in water supply	1921-5	1906-10	1911-15	1915
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albany ... 107,979	Hudson river ...	Prefilters, slow sand filters and sterilization	Sand filters installed 1899. Prefilters installed 1908. Hypochlorite plant installed 1909	1889-1899 88·8	1900-1915 20·3	21·8	17·0	18·3	12·0
Amsterdam * 34,319	Hans creek and Steele creek with large reservoirs	No treatment ...	Progressive improvement, two small polluted streams abandoned, 1910	1898-1910 28·4	1911-1915 11·0	23·8	14·9	11·0	11·7
Auburn* ... 32,468	Owasco lake ...	Sterilization ...	Hypochlorite apparatus installed 1911, Liquid chlorine treatment since 1913	1898-1910 20·3	1911-1915 14·3	20·6	18·2	14·3	27·8
Batavia ... 13,278	Tonawanda creek	No treatment ...	Filters to be installed...	... ...	... ...	36·9	31·0	16·5	0·0
Beacon* ... 10,825	Surface streams. Auxiliary supply from Fishkill creek	Auxiliary supply sterilized when used	Liquid chlorine plant installed in 1914	... ...	... ...	...	...	29·2	9·8
Binghamton... 53,668	Susquehanna river	Mechanical gravity filters	Filters installed in 1902	1889-1902 50·3	1903-1915 12·3	22·2	13·6	12·0	9·3
Buffalo ... 454,630	Lake Erie ...	Sterilization ...	Liquid chlorine plant installed 1913	1901-1913 24·1	1914-1915 13·4	29·2	23·3	15·6	10·6
Canandaigua 7,501	Canandaigua lake	No treatment ...	... ...	... ...	... ...	34·4	38·5	21·7	26·7
Cohoes* ... 23,433	Mohawk river ...	Mechanical gravity filters and sterilization	Filters and hypochlorite apparatus installed in 1911	1888-1911 84·8	1912-1915 28·3	88·9	71·4	45·3	17·1
Corning* ... 13,459	Dug well ...	Sterilization ...	Liquid chlorine plant installed 1915	... ...	... ...	38·4	52·2	25·4	0·0

Cortland* ... 12,367	Dug well ...	No treatment ...	Gradual improvements to protect well	... ...	... ...	32·4	28·6	18·5	8·1
Dunkirk* ... 17,870	Lake Erie ...	Sterilization ..	Liquid chlorine plant installed May, 1914	1898-1914 34·5	1915 16·8	43·7	29·7	31·8	16·8
Elmira* ... 40,073	Chemung river ...	Mechanical gravity filters and sterilization	Filtered since 1896. Hypochlorite used since 1911	1888-1896 53·8	1897-1910 39·2	1911-1915 12·1	45·1	32·8	12·1	10·0
Fulton* ... 11,138	Dug wells ...	No treatment ...	Gradual improvements to eliminate surface water and Oswego river water	... ...	... ...	37·3	17·6	25·2	27·0
Geneva* ... 13,232	Seneca lake ...	Slow sand filters	Filters installed 1914 ...	1898-1913 31·3	1914-1915 18·9	36·4	20·1	31·2	15·2
Glens Falls ... 16,323	Surface streams and storage reservoir	No treatment ...	... .	... ...	... ...	35·0	30·8	17·5	12·3
Gloversville... 21,178	Surface streams and storage reservoirs	No treatment ...	... ...	... ...	... ...	18·5	13·6	10·3	0·0
Hornell* ... 14,352	Seeley creek ...	Mechanical pressure filters and sterilization	Filters installed in 1899. Water supply rules enacted 1913. Liquid chlorine plant installed 1915	1890-1899 55·0	1900-1915 20·1	31·6	17·4	10·0	0·0
Hudson ... 11,544	Taghkanic creek and Churchtown reservoir	Slow sand filters	Filters installed in 1874 Hudson river source abandoned 1905	1898-1904 78·6	1905-1915 28·9	73·8	25·4	28·5	26·1
Ithaca* ... 16,750	Six Mile creek ...	Mechanical gravity filters and sterilization	Filters installed in 1903 following typhoid epidemic. Hypochlorite used since 1914	1898-1903 78·4	1903-1915 18·6	90·1	15·2	23·1	29·9
Jamestown ... 37,780	Driven wells ...	No treatment ...	... ...	... ...	... ...	27·9	23·1	14·3	5·3
Johnstown .. 10,688	Surface streams...	No treatment ...	Gradual improvement in sanitary conditions on watershed	... ...	... ...	12·1	10·2	7·5	9·3
Kingston* ... 26,354	Sawkill creek ...	Mechanical pressure filters and sterilization	Filters installed in 1898. Hypochlorite plant installed in 1912	1898-1911 19·6	1912-1915 18·1	18·2	23·1	19·9	7·6
Lackawanna* 15,737	Lake Erie ...	Sterilization ...	Liquid chlorine plant installed in 1913	... ...	... ...	...	...	5·0	6·4

TABLE II.—WATER SUPPLY AND TYPHOID FEVER IN THE CITIES OF NEW YORK STATE—*Continued.*

CITY AND POPULATION (State Census of 1915)	Source of water supply	Present treatment	Remarks	TYPHOID FEVER DEATH-RATES (Average annual deaths per 100,000 population)				
				Before improvement in water supply	After improvement in water supply	1901-5	1906-10	1911-15	1915
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Little Falls ... 13,022	Surface streams...	Slow sand filter for portion of supply	... ...	... ...	... ...	26·0	19·2	17·2	7·7
Lockport* ... 18,693	Niagara river ...	Sterilization ...	Source changed in 1909 from Erie canal to Niagara river. Liquid chlorine plant installed 1913	1898-1908 57·2	1909-1913 33·2 1914-1915 7·7	53·8	47·8	33·1	5·3
Miechanicville 8,208	Surface streams..	Supply partly filtered in slow sand filter	Filter installed in 1909	1901-1909 19·9	1910-1915 11·6	29·6	12·3	7·9	0·0
Middletown 17,381	Surface streams...	Mechanical gravity and pressure filters	Filter installed in 1900	1894-1900 31·0	1901-1915 26·5	26·2	24·8	28·5	12·2
Mt. Vernon* 37,583	Surface streams...	Slow sand and mechanical pressure filters and sterilization	Filters installed 1894. Hypochlorite used since 1909 for Mamaroneck river source. Liquid chlorine plant recently installed	1898-1908 14·7	1909-1915 8·8	14·3	16·2	8·9	5·3
Newburgh ... 27,876	Silver creek and Washington lake	Sterilization ...	Hypochlorite used since 1914	1898-1913 38·4	1914-1915 17·5	36·9	41·8	29·6	14·3
New Rochelle* 31,758	Surface streams and driven wells	Sterilization ...	Hypochlorite used since 1913	1898-1913 16·6	1914-1915 7·8	24·9	20·1	6·8	15·7
New York City 5,468,190 (est.)	Croton river, Bronx river, Byram river, surface streams and driven wells	Sterilization ...	Hypochlorite plant installed in Croton aqueduct 1912. Liquid chlorine treatment to be used	1901-1912 15·1	1913-1915 6·5	18·1	14·0	8·1	6·1

Niagara Fall* 42,257	Niagara river ...	Mechanical gravity filters and sterilization	Water company supply, and municipal supply filtered since 1912. Water company supply partly filtered prior to 1912. Hypochlorite treatment of municipal supply. Liquid chlorine treatment of water company supply in each case since 1912	1898-1911 128·4	1912-1915 28·7	145·1	108·1	60·4	0·0
North Tonawanda* 13,498	Niagara river ...	Sterilization ...	Liquid chlorine plant installed November, 1914	1898-1914 36·8	1915 29·6	25·3	43·7	45·2	29·6
Norwich ... 8,342	Chenango lake and surface streams	Mechanical pressure filters and sterilization	Filters installed in 1905. Hypochlorite plant installed later	1901-1905 11·9	1906-1915 8·8	11·9	0·0	17·5	12·0
Ogdensburg * 14,338	St. Lawrence river	Slow sand filters	Filters installed in 1913 and source changed from Oswegatchie river	1898-1912 50·0	1913-1915 16·5	55·5	41·1	23·4	7·0
Olean ... 17,925	Driven wells ...	No treatment ...	... ...	... ...	... ...	20·4	14·5	11·2	11·2
Oneida ... 9,461	Surface stream ...	No treatment ...	... ...	... ...	... ...	20·0	15·9	7·1	0·0
Oneonta* ... 10,474	Oneonta creek ..	Mechanical pressure filters and sterilization	Filters installed since 1906. Hypochlorite treatment	1899-1906 35·8	1907-1915 32·1	36·3	48·2	19·4	28·6
Oswego ... 25,426	Lake Ontario ...	Sterilization ...	Oswego river source abandoned for Lake Ontario in 1910. Hypochlorite treatment	1898-1910 45·4	1911-1915 17·5	48·0	53·6	17·5	11·8
Plattsburg* ... 10,134	West brook and reservoirs	Sterilization ...	Hypochlorite plant installed in 1915	... ...	... ...	21·1	21·9	37·1	29·7
Port Jervis* ... 9,413	Surface ponds and streams supplemented by Neversink river	Sterilization of Neversink river supply when used	Hypochlorite treatment of Neversink river water, when used, since 1914	... ...	... ...	60·4	33·3	21·0	31·9

* Indicates municipalities where improvements in the public water supply have been made following investigations and recommendations of the department.

TABLE II.—WATER SUPPLY AND TYPHOID FEVER IN THE CITIES OF NEW YORK STATE—*Continued*.

City and Population (State Census of 1915)	Source of water supply	Present treatment	Remarks	Typhoid Fever Death-rates (Average annual deaths per 100,000 population)				
				Before improvement in water supply	After improvement in water supply	1901-5	1906-10	1911-15	1915
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Poughkeepsie* 32,714	Hudson river ...	Slow sand filters and sterilization	Filters installed in 1872; improved 1907. Hypochlorite plant installed 1910. Liquid chlorine plant installed 1913	1898-1907 45·2	1908-1909 28·7 1910-1915 13·9	41·7	45·3	13·1	24·2
Rensselaer ... 11,210	Hudson river ...	Mechanical gravity filters and sterilization	Filters installed 1901. Hypochlorite plant installed 1911	1898-1901 102·6	1902-1910 46·1 1911-1915 7·4	62·3	33·0	7·4	8·9
Rochester ... 248,465	Hemlock and Canadice lakes	No treatment ...	... ...	... ...	... ...	13·6	13·0	9·5	5·6
Rome ... 21,926	Fish creek ...	No treatment ...	Source changed from Mohawk river to Fish creek in 1909	1898-1909 23·0	1910-1915 16·8	24·6	21·4	16·3	9·1
Salamanca ... 8,370	Springs and driven wells	No treatment ...	... .	... ...	... ...	12·4	27·0	9·8	0·0
Saratoga Springs 13,792	Loughberry lake	No treatment ...	... ...	... ...	... ...	40·1	23·3	30·1	21·8
Schenectady 80,381	Large wells intercepting ground water flow to river	No treatment ...	Use of Mohawk river water discontinued 1903	1890-1903 86·0	1904-1915 10·6	26·2	11·0	8·1	13·7
Syracuse ... 145,293	Skaneateles lake	No treatment ...	Since 1906 watershed protected by revised rules more rigidly enforced	1898-1906 19·7	1907-1915 14·0	14·4	14·9	12·2	6·2
Tonawanda ... 9,147	Niagara river ...	No treatment ...	... ...	... ...	... ...	23·3	46·9	30·5	0·0
Troy... ... 75,488	Surface streams and lakes	No treatment ...	Partial use of Hudson river water discontinued 1906	1898-1906 55·7	1907-1915 24·2	45·7	27·7	23·1	21·2

Utica* ... 80,589	West Canada creek and small surface streams	West Canada creek water sterilized since 1914	Since 1906 watershed protected by revised rules more rigidly enforced	1898-1906 18·2	1907-1914 11·6	1915 3·7	16·0	17·1	7·8	3·7
Watertown* 26,895	Black river ...	Mechanical gravity filters and sterilization	Filters installed 1904 following typhoid epidemic. Hypochlorite used since 1911	1898-1904 94·9	1905-1911 46·5	1912-1915 13·3	81·2	50·9	18·1	22·3
Watervliet* ... 14,990	Mohawk river; occasional use of Hudson river water	Sand filter (obsolete)	Source of supply being changed to Normanskill	... ...	... ...	...	56·6	32·5	49·8	40·0
White Plains 19,287	Driven wells, dug wells and surface stream	No treatment ...	... ...	... ...	... ...	...	9·5	14·9	14·6	10·4
Yonkers ... 90,913	Saw Mill, Sprain and Grassy Sprain rivers	Slow sand filters and sterilization for Saw Mill river supply	Two slow sand filter units installed in 1904. Hypochlorite plant installed in 1910. Two additional filter units installed in 1909 and two in 1915	1898-1904 11·8	1905-1909 7·2	1910-1915 10·2	11·2	10·6	8·5	8·8

* Indicates municipalities where improvements in the public water supply have been made following investigations and recommendations of the department.

Annual Typhoid Fever Death-rates per 100,000 Population in New York State 1885-1915.

1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915
19·0	20·4	22·7	24·9	25·6	26·1	30·5	25·8	25·7	24·7	25·4	22·6	19·4	25·6	22·4	26·7	23·4	17·4	21·5	20·9	19·2	19·0	19·8	16·0	15·1	15·0	14·0	11·8	10·5	8·8	7·4

Typhoid fever death-rate per 100,000 population in the cities of the State (combined population, 7,719,736) for 1915=7·5.

then, to note in the table that, notwithstanding this difficulty, the typhoid fever death-rate in cities in the past two years has been reduced from 10·5 per 100,000 in 1913 to 7·4 in 1915, corresponding to an average yearly reduction of 1·55 per 100,000, which is substantially the same as the average yearly reduction maintained during the eight-year period referred to.

In connection with any comparative study of a table of this character endeavouring to show the relation between typhoid fever death-rates and improvements in the quality of public water supplies, a question naturally arises as to how far the typhoid fever death-rates in these municipalities may be affected by other sources of infection, such as milk, oysters, secondary infection from contact or carriers, &c., not associated with water supplies. Our experience in this State, however, has indicated what is generally accepted among epidemiologists in this regard, viz., that, whereas these secondary causes, such as infected milk, oysters, and other raw foods and secondary infection, hitherto classified as "residual typhoid," may and generally do account for an appreciable and significant percentage of the total typhoid fever death-rates, especially in municipalities where the typhoid fever death-rates are comparatively low and the water supplies are known to be comparatively pure, this percentage is, however, relatively much smaller for municipalities where the typhoid fever death-rates are high and where the water supplies are not of recognized purity. Furthermore, it is well known that typhoid fever arising from milk, oysters, and other raw foods is usually of an explosive character and generally of brief duration. With these facts in mind, a study of the table, and of our records of milk-borne, oyster-borne, and other similar outbreaks in the past, indicate that with very few, although important exceptions, the cities included in the table have not suffered in any clearly marked degree from typhoid due to such causes.

The fact that the typhoid fever death-rates in cities have been reduced to comparatively low figures is strong evidence that the present rates represent largely so-called "residual typhoid" due to these secondary causes referred to. In other words, it is obvious that for a further reduction of typhoid fever in these and many other cities in the list we must look to an elimination of these secondary causes, particularly those due to milk infection and secondary infection from contact and "carriers."

Milk-borne Typhoid.

The continued presence of the so-called "residual typhoid" denotes a lack of complete sanitary control, as alluded to at the commencement of this paper. The lack of due care in the disposal of excreta has been the cause of several milk-borne epidemics in New York State. In a small epidemic in Roxbury the source of infection was found to be milk, for all the cases had taken milk from the same dairyman. The well water used by the dairyman was found to be dangerously near the privy, and analyses of the water revealed coli. Careful inquiry revealed the fact that a young daughter had been away, and while away had been ill with a fever. Examination of the excreta of this girl at the State Laboratory showed the presence of typhoid bacilli.

A number of cases of typhoid fever developed within a few days in the village of Greenwich last spring. The health officer reported these cases to the Department, and an epidemiological survey showed that all the cases had developed in families taking milk from the same dairy farm, and that there were no cases that had not partaken of this milk. An examination of this dairy farm revealed the presence of a case of convalescent typhoid who had resumed

his occupation of milker on the dairy farm. Upon removing this man from the farm no more cases developed among persons taking milk from this farmer, although there were one or two cases which developed in families where a case already existed. Another instance occurred in the town of Newburg, which is one of unusual interest.

History of a Typhoid Carrier in the Town of N., N.Y.

A. G., aged 55, has run a dairy farm in the town of N., on the outskirts of the city, for the past ten years or more. The milk produced on his place has been sold in the city of N.

About sixteen years ago he had an attack of typhoid fever, has been in good health since that time, does the work on his farm, including milking, assisted by his son and other members of his family.

The city of N. has the following typhoid history :—

1909	...	110 cases of typhoid reported with 12 deaths.
1910	...	65 " " " " " 13 "
1911	...	57 " " " " " 11 "
1912	...	76 " " " " " 12 "
1913	..	23 " " " " " 7 "
1914	...	32 " " " " " 6 "
1915	...	40 " " " " " 6 "
1916	...	No cases reported thus far this year.

In 1912-13 the milk supply was suspected, and examinations were conducted by the local authorities and by the State Department of Health. Mr. G. was implicated and had a long controversy with the State and local officials, but it could not be ascertained that anything was ever definitely proven against his milk supply.

During 1913 the present health officer, Dr. T. J. B., accepted the position as health officer, and it was due to his activity that the typhoid morbidity was lowered, the cases decreasing from 50 to 75 a year to 20 and 30. This was

accomplished by following up the milk supply in each outbreak and shutting off the suspicious places. When the outbreak would cease these suspicious places would number four to six dairy farms, and Mr. G.'s place was always one of the number.

In 1914 an outbreak of thirty-two cases occurred, which was traced to the ice-cream manufactured at C.'s factory in N., where it was thought that an adjacent privy had infected the water of a pond where the cans were washed and this caused the epidemic. However, the milk from which the ice-cream was made came from the G. farm.

Early in 1915 another outbreak occurred and again was traced to a few farms, one of which was G.'s place. Widal tests were made of all persons on the farms, and specimens of fæces sent from all on the G. farm to Albany for examination. Through some delay in travel the examinations were worthless, and other specimens could not be obtained. G. was, however, warned against selling any milk in N.

Later in 1915 typhoid broke out again and traced to a dealer in milk named P. His milk came from a dairy where one of the helpers had typhoid three years ago. A careful examination of blood and fæcal specimens from this helper proved negative. It was, however, learned at this point that, his own supply of milk being short, Mr. P. had been quietly obtaining a couple of cans (eighty quarts) of milk per day from Mr. G., and that he had used this milk in his own family. Two weeks from the time he got his first supply from G. one of his family was taken with typhoid, followed shortly after by another. The same thing happened all along his milk route.

The sanitary supervisor of the district, with the help of Dr. E. P. B., the health officer of the town of N., finally succeeded in getting a fresh specimen of fæces from Mr. G.

This was immediately taken to the laboratory of B. and N. Y. U. and delivered to Dr. N. Within three hours' time Dr. N. reported the specimens teeming with typhoid bacilli, and is now running a culture from this specimen in his laboratory.

A specimen of blood from Mr. G. is positive for the Widal reaction.

We feel that the high typhoid morbidity of the city of N. is explained by the above statement, as the water supply has been treated with hypochloride of lime for the past two years with no effect on the typhoid outbreaks.

Mr. G. has gone out of the dairy business since the last outbreak.

N. is now under a Commission for a government, and we have started some agitation to have a city pasteurization plant installed.

There have also been a few other epidemics or outbreaks of typhoid fever definitely milk-borne in character that have occurred in the State of New York since 1914.

TABLE III.—MILK-BORNE OUTBREAKS OF TYPHOID FEVER IN NEW YORK STATE (FROM MAY 1, 1914 TO JANUARY 1, 1916).

Place	Time	No. of Cases	No. of Deaths
Wellsville	June, 1914 ...	13 ...	2
Salisbury Mills ...	November, 1914 ...	19 ...	3
Amsterdam	June, 1915 ...	8 ...	2
Auburn	August, 1915 ...	31 ...	3
Bullville	September, 1915 ...	8 ...	2
Elmira and Southport ...	November, 1915 ...	20 ...	2
Greenwich	December, 1915 ...	12 ...	—
Kingston			

TYPHOID CARRIERS.

A closer study of typhoid epidemics and smaller typhoid outbreaks has frequently revealed a carrier as the source of the outbreak. Under the direction of Dr. F. M. Meader, Director of the Division of Communicable Diseases, several

of the sanitary supervisors have detected typhoid carriers, and Dr. Meader himself has also discovered a number as follows :—

TABLE IV.—TYPHOID CARRIERS IN NEW YORK STATE, 1916.

Name	Address	Occupation	Date found	Date had typhoid	No. of cases infected	
					Direct	Indirect
C. C. ...	Kingston, N.Y.	Farm labourer	2.8.16	4.11	11	—
J. G. ...	Wellsville, ,,	Farmer	3.13.16	1910	6 or 8	—
G. G. ...	Bullville, ,,	,,	10.8.15	1911-12	—	—
C. S. G. ...	Roxbury, ,,	Helper on dairy	12.10.15	...	...	14
A. G. ...	Newburgh, ,,	Farmer	3.20.15	1900	Possibly 40 to 100 per year	—
A. L. ..	T. Potsdam, ,,	Servant	7.7.15	...	13	2
Mrs. MacR.	Clayton, ,,	Housewife	2.15.16	...	3	2
W. McN. ...	T. Fulton, ,,	Farmer	1.14.16	1902	2	3
A. M. ...	Bouckville, ,,	,,	...	10.14	—	—
C. P. ...	Whitesboro, ,,	,,	1914	10.11	3 (Milk route Utica)	—
Mrs. T. W.	Carthage, ,,	Milliner	1.5.16	1901	2	3

There are also under supervision twenty-eight carriers in New York City, making a total of thirty-nine in New York State.

From examinations made of individuals convalescent of typhoid fever, it seems quite evident that at least 2 per cent. of the total number of individuals who are affected with typhoid fever remain permanent carriers. The presence of such a large number of carriers has brought up an entirely new public health problem, for these carriers are responsible for many epidemics of typhoid fever.

The matter is of unusual importance when a typhoid carrier is engaged in one of the numerous occupations which have to do with the preparation and handling of food. Dairymen and workers in dairies, milk-houses, pasteurizing plants,

waiters and waitresses, who are typhoid carriers are a constant menace to the public health. The increasing use of pasteurization has diminished to a certain extent the likelihood of outbreaks of typhoid fever from typhoid carriers on dairy farms.

It has become necessary then for the health authorities to provide some special rules and regulations for the control of typhoid carriers. Chapter II, Regulation 40 of the Sanitary Code, reads as follows: "Any person who is a carrier of the disease germs of Asiatic cholera, bacillary dysentery, diphtheria, epidemic cerebrospinal meningitis, poliomyelitis (infantile paralysis), or typhoid fever shall be subject to the special rules and regulations of the State Department of Health."

In accordance with this regulation the Commissioner of Health of the State has drawn up the following provisional regulations:

Rules and Regulations for the Control of Typhoid Carriers.

The Carrier State.

Typhoid carriers are persons who harbour typhoid organisms in their excretions from the bowels and sometimes the urine. This condition may follow recovery from typhoid fever, or the course of the disease may be so mild that the patient does not realize that he was suffering from typhoid fever. Nurses who have cared for typhoid fever cases and do not know that they have ever had typhoid fever have been found to be typhoid carriers. Sometimes there is no objective or subjective symptoms that would lead one to suspect that he was a carrier, and other times the patient has a cholecystitis with more or less marked symptoms. Rarely a periostitis may develop with a discharging sinus due to typhoid organisms.

About 20 per cent. of cases of typhoid fever are discharging typhoid organisms six weeks from the date of

onset. It is believed among sanitarians that about $\frac{3}{10}$ per cent. of the general population are typhoid carriers. The reason why people become carriers is not fully understood, but a reasonable explanation for many cases is the following :—

These organisms multiply at a very rapid rate by simply lengthening out and splitting open in the middle several times during each hour. The gall-bladder becomes infected occasionally with these organisms, and sometimes becomes the nucleus of gallstones. The bile discharges into the intestinal tract after each meal. A few organisms are left in the gall-bladder to form a nidus from which they continue to grow. This process continues day after day, and in many instances year after year. We have persons who have apparently been carriers for a period of fifty years or more.

Extent of Danger to Community.

There are a great many typhoid carriers in the State. We already know of twenty-eight in New York City, and eleven in the remainder of the State. There are very large centres of population in the State where typhoid fever has always existed in which the search for carriers has not been made, so that their presence has not been detected. Probably many carriers are not a source of public danger because of the cleanly habits which they practice. One person has been thought to have been a carrier for thirty years. The discovery of the fact that she was a carrier was purely accidental. It could not be determined that she ever had infected anyone. The explanation was that her home was always kept in a very sanitary condition, and improved sanitary facilities were always available.

It is chiefly where carriers are engaged in the handling of raw foods, such as cooks, waiters, dairymen, ice-cream manufacturers, and where the sanitary conditions are such that flies have access to their excreta that their real danger to the community exists.

Precautions to be taken.

The first and most valuable precautionary measure is to let the person know that he is a typhoid carrier. When this is done the carrier is able to care for himself in such a manner that he will not menace the health of his neighbours.

The second measure is to prohibit the carrier emerging in an occupation where raw foods will be handled.

The third precaution applies to the disposal of the excreta. If flush closets are available the water in the bowl should be dosed with two tablespoonfuls of chloride of lime before using. If only privies are available, they must be made tight so that flies will not have access to the excreta, and it must be dosed with a strong chloride of lime solution at frequent intervals. Provision must be made for the frequent disinfection of the hands by washing them with soap and water, and by the occasional disinfection with such a disinfectant as lysol.

Fourth, a carrier should always use his own personal towel, and no one else should be allowed to use it.

Fifth, it is required that the remaining members of the family and those who associate with the carrier must be immunized with typhoid vaccines. The Department will be glad to supply the physician with vaccine free of charge.

Sixth, a carrier must not leave his home without first notifying the health officer of his municipality, stating the place to which he plans to go, and a record should be kept of the hotels and other places where he resides when away from home.

Seventh, when a carrier is on a journey ample provision must be made for disinfecting his excreta, or for burying the same, and particular attention must be given to the disinfection of his hands.

Eighth, if there is a well or spring at the home of the patient, it must be amply protected from drainage water and from underground currents that might contain the infectious agent.

Treatment of Typhoid Carriers.

The cure of these cases is one that has taxed the ability of the medical profession without any great success. The gall-bladder has been removed in many instances and drained in others. A few cures have been reported by this procedure. The treatment with large doses of hexamethylenamina has been used without success, except in those cases where the infection is localized in the urinary bladder. Sodium salicylate has been used extensively with no apparent result.

Immunization with typhoid vaccines has been apparently successful in some instances. Charcoal and iodine have apparently been used successfully in some cases. Kalberlah is reported to recommend five to fifteen drops of tincture of iodine in a glass of water half an hour after eating three to five times a day, and blood charcoal in teaspoonful doses at the same time.

The Department will be glad to suggest methods of treatment to those interested.

Contact Infection.

But little need be said except to point out the importance of early diagnosis and the necessity of carrying out explicitly rules and regulations provided for a sanitary disposal of excreta and the care of the hands while caring for a case of typhoid fever.

Flies.

Since the famous report of Reed, Vaughan, and Shakespeare on the extent of typhoid fever in the United States Army in the Spanish War, there has been considerable reference to the importance of flies as possible carriers of typhoid bacilli. No typhoid instance has come to our knowledge in New York State of this type of infection, but I desire to make a passing reference to the work of C. E. Terry of Jacksonville. In 1910 there were 329 cases and 62 deaths from typhoid, and during this year an ordinance was enacted requiring the proper construction and maintenance of privies relating especially to fly-proofing. At that time there were approximately 8,000 privies in Jacksonville, and 40 per cent. of the population used them. Notwithstanding the tremendous growth of the city, its increase in population and the amount of sewers constructed, in 1915 the Health Board records still showed that over 6,000

persons, or 30 per cent. of the population, were still using privies.

TABLE V.—JACKSONVILLE, FLA.

YEAR	TYPHOID FEVER	
	Cases	Deaths
1910	329	62
1911	158	40
1912	94	18
1913	85	22
1914	119	28
1915	92	14

The water supply in Jacksonville has for years been derived from artesian wells of unusual purity. The milk supply is said to be excellent, and no epidemic has been found to be milk-borne in character, nor have any preventive measures been undertaken with the milk or water supply, and the reduction in the number of cases and deaths furnishes the most striking evidence that has yet been afforded to show that the mere screening of the privies reduces the amount of typhoid fever. The cases in 1915 were ninety-two in number, deaths fourteen.

THE METHOD OF CONTROL.

Typhoid fever is declared to be a communicable disease by the Public Health Council, and the Sanitary Code and Public Health Law requires every physician to report cases of typhoid fever as soon as diagnosis is made.

An interesting study has been made by Dr. Meader of the Department, of the number of cases reported and the number of deaths in various counties of New York State. During the year 1915, in a number of the more rural counties, it was found that the fatality rate exceeded 100 per cent.—that is, more deaths were reported from typhoid fever than there were cases. In taking a summary of the deaths

and cases reported for the entire year, it was found that approximately 75 per cent. of the fatal cases were reported.

Every effort is now being made to secure the reporting of cases of communicable disease, and, in particular, typhoid fever. Whenever a case is reported to the health officer, he is charged with the duty of seeing that the excreta are properly disposed of, and that a circular on the subject of typhoid fever is delivered to the head of the household. He also is required to ascertain the source of the milk supply, water supply, and whether the patient has had typhoid before, and whether any of his family, relatives, or friends have had typhoid fever in the past. In short, to make every inquiry to ascertain the source of the fever. This information is placed on the form card, which is returned to the Department.

As soon as the case is reported to the Department a circular letter (form attached) is sent to the sanitary supervisor of the district in which the health officer is situated, and he also visits every case of typhoid fever, excepting in cities, and sees that the directions given in the circular are properly carried out, and also sees that the health officer fully appreciates the importance of this sanitary work. When there has been a sudden outbreak of a number of cases of typhoid fever the sanitary supervisor makes a more detailed study, and if necessary calls upon the Department for further assistance. The water supply is examined into and data are secured from the Division of Sanitary Engineering, which now has accumulated data on nearly all the water supplies of New York State, and by the end of this year will have accumulated data on all the 500 odd water supplies in the State, whereby by the process of exclusion one source of infection is eliminated. It is quite obvious that the cause of many cases of typhoid cannot be ascertained, and this is

well shown in a recent publication of the New York City Department of Health as follows:—

These figures, as given by the New York Department of Health, are as follows:—

Source	1915	1905
Out-of-town	372	535
Direct exposure	165	225
Milk	112*	525†
Food contaminated by flies carrying typhoid infection	95	
Carriers	118	
Water melons floating in polluted harbour water	12	
Oysters		124
Water		864
	874	2,273
Unknown	1,582	1,312
	2,456	3,585

* Milk contaminated after pasteurization, by infected well water used at the creamery.

† Raw milk.

During the present year the State Department has not been equipped to do any detailed study such as is now under way, but it is hoped that, with the present staff and the present method, typhoid fever can be more readily controlled than it ever has been in the past. The steadily diminishing death-rate from typhoid fever is most gratifying, but the rate for the State outside of New York City is still nearly 50 per cent. more than the death-rate in New York City. It has, however, diminished since 1908 from 20 per 100,000 to 9 per 100,000.

DISCUSSION.

Dr. ARTHUR K. STONE (Boston, Mass.): The history of typhoid fever in Massachusetts is particularly interesting. The reduction in the number of deaths from 768 in 1885 to 196 in 1915 tells an eloquent story for the work of the sanitarian. (For rates *see* table and graph attached). It was in 1911 that the rate per 100,000 of population dropped below ten for the first time. The important factors in this

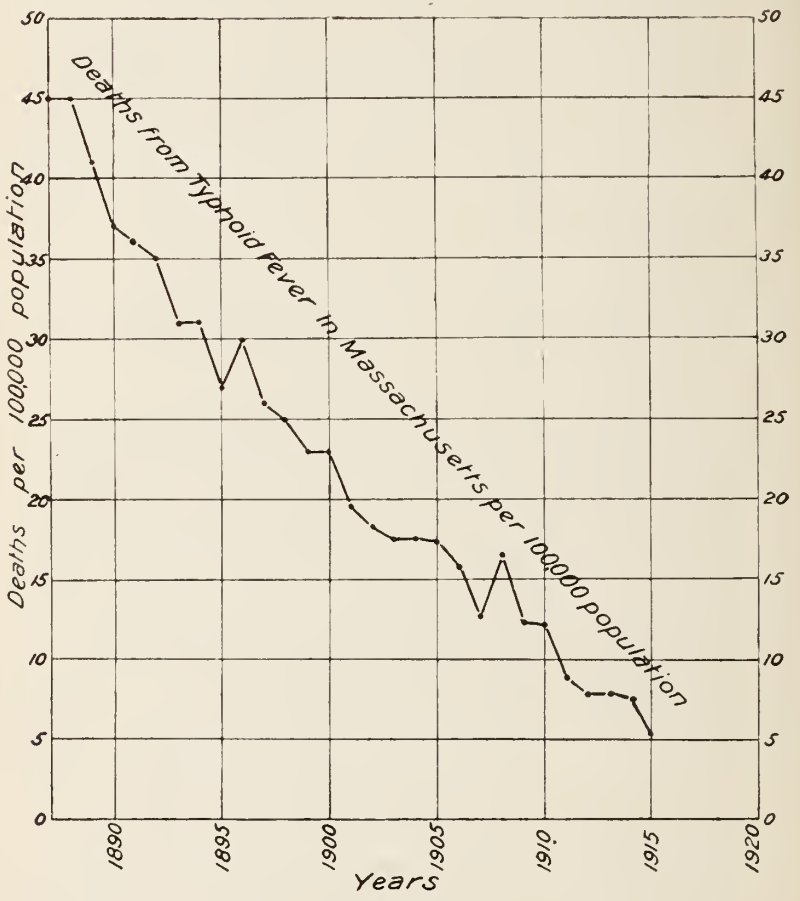
reduction in typhoid fever have been improved milk and water supplies, better reporting of cases, more thorough investigation, better diagnostic laboratory facilities, and the free distribution of anti-typhoid vaccine. While the reduction in the morbidity and mortality rate from this disease has been great, it still remains an important problem. As Dr. Allan J. McLaughlin, Commissioner of Health of Massachusetts, has said, in a paper read before the Boston Medical

DEATHS AND DEATH-RATES PER 100,000 POPULATION IN MASSACHUSETTS FROM TYPHOID FEVER.

Year	Deaths	Death-rate	
1885	768	39·0	from p. 763 of "The Vital Statistics of Mass." 1856-95.
1886	800	40·0	
1887	922	45·0	
1888	943	45·0	
1889	891	41·0	
1890	835	37·0	
1891	821	36·0	
1892	827	35·0	
1893	750	31·0	
1894	748	31·0	
1895	680	27·0	
1896	723	30·0	
1897	607	26·0	
1898	663	25·0	
1899	612	23·0	from p. 10 of Mr. Mills' Address, April, 1913.
1900	632	23·0	
1901	561	19·5	
1902	538	18·3	
1903	527	17·5	
1904	463	17·5	
1905	520	17·3	
1906	477	15·7	
1907	389	12·6	
1908	517	16·5	
1909	390	12·3	
1910	411	12·2	
1911	302	8·8	
1912	269	7·7	
1913	280	7·8	from State Registration Reports.
1914	268	7·3	
1915	196	5·3	from 1915 Bulletins, figures incomplete.

Library and the Suffolk District Medical Society in April, 1912, it will be very difficult to get rid of the last vestiges of the infection of typhoid fever when the rate drops below 10 per 100,000. The work of the State Department of Health of Massachusetts in the matter of typhoid fever at the present time is being conducted with a view of overcoming the so-called endemic typhoid fever. To bring this about there has been established a system of records which gives a sensitive check of all cases of typhoid fever in the Commonwealth. The State District Health Officers (now full-time health officials) personally

investigate and follow up all cases of typhoid fever. The State water supply in the cities and towns in Massachusetts is a particularly safe one. The outbreaks due to water-borne infection are few and far between. An intensive study of the milk supply, made by the special Milk Board during the last year, has shown that the relative import-



ance of infected milk in the transmission of typhoid fever is rather low in Massachusetts. The question of typhoid fever "carriers" is being attacked vigorously by means of a careful epidemiological investigation of cases with a thorough laboratory examination and careful follow-up work. For the prevention of typhoid fever the State of

Massachusetts furnishes the typhoid vaccine free to every resident in the State. Efforts are being made to induce everyone who has not had typhoid fever to have this prophylactic administered.

Dr. ROCHESTER: I should like to ask Dr. Williams whether the sterilization of the water by chlorine has been studied? I ask this question because in Buffalo we have chlorinated the water supply. This was done by the Health Department. Whereas previously the Commissioner of Health had given out instructions that everybody should boil their water, he stated that from that time on the water supply was perfectly good. In one of our families, where they had been very careful previously about boiling the water, after this announcement they began to drink from the tap, and about two weeks afterwards a young woman of the family came down with typhoid fever. She had not been out of the city, and there had been no possible source of infection except from drinking the city water. I should simply like to ask the question whether the sterilization of water by chlorine has been perfectly studied?

Dr. LINSLY WILLIAMS: The question of filtration is chiefly one of intelligent operation. We find that some of the smaller places need to be constantly watched. In the larger places, however, the work is very satisfactory. We found, for example, at a reformatory, where they have a sewage disposal plant, consisting of sand filtration, that the bacteria are absolutely absent in the trough below the place where the supply comes in; but the water in the trough above is not as good as the water below after receiving the correlated affluvia which makes up the sediment—which shows that the State is making the water supply a little bit better than before. The question of treatment of typhoid carriers is a very different one, and one that I do not feel competent to go into. I know there have been a certain number of carriers who, when the gall-bladder has been removed, have stopped shedding typhoid bacilli; and a number who, after having been given autogenous vaccines have stopped shedding bacilli; but whether this is due to the fact that sometimes they do stop shedding bacilli from unknown causes, or whether it is due to the vaccine, I am not prepared to say. As far as we can learn, the typhoid carrier who is a physically clean citizen and who is not engaged in handling food products is of no danger to anyone, but otherwise there is a certain danger.

TREATMENT OF DIABETES.

By F. FREMONT SMITH, M.D.

It has been accepted by the profession, until very recent years, that treatment of diabetes was satisfactory which reduced the sugar output to a moderate percentage, prevented much acidosis, neuritis, subjective symptoms, and escaped coma. Only of late has any physician suspected an ideal treatment with the highest result as distantly possible. That *extraordinary* benefits to the organism could come from continued absence of urinary sugar, or that the hope might be entertained of practically continuous aglycosuric conditions, with possible absolute cure, was scarcely conceivable.

Once, however, the idea is established that nearly every patient can be made sugar-free and kept so, while following a definite plan of diet, the interest and enthusiasm of both doctor and patient, and the self-education and co-operation of patient are inevitable.

Guelpa read a notable paper before the British Medical Association in July, 1910, entitled "Starvation and Purgation in the Relief of Disease," recently reviewed by Kellogg. This article maintained that diabetes mellitus is due to auto-intoxication from intestinal putrefaction, which has never been proven, reporting many cases made sugar-free in short periods of time by frequent starvations; usually accomplishing this in two or three days, and demonstrating that

repeated fasting periods caused in some instances permanent aglycosuria.

Bardet later stated before the Societe de Medicine that Guelpa's discovery had "completely upset established ideas" as to diabetes. Guelpa also reduced carbohydrates and proteins, and eliminated the dread of acidosis and coma for fasting diabetics. He changed intestinal flora, which has been proved reduced arterial tension, relieved neuritis, and improved the general health.

Fasting, which in normal man produces acidosis, has no such influence in the glycosuric, excepting in very rare instances, as lately pointed out by Stillman. In the "green diet" Von Noorden and Naunyn had earlier recognized the same principle, but had not emphasized the idea or employed it successfully. Allen has scientifically demonstrated it by animal and human experimentation. In 1914 he reported results in depancreatized animals, the ducts remaining *in situ*, along with the small portion or retained pancreas, producing at will by diet all stages of diabetes. In his produced mild cases, by restriction of carbohydrates and proteins, subsequent to a day or two of fasting, he kept the animals sugar-free indefinitely, though they lost some weight, retaining, however, both strength and activity.

In more severe induced cases, where the fast was prolonged to a week or more, and the diet greatly reduced for the purpose of depressing metabolism, return to increase in weight and metabolism were accompanied by a recurrence of sugar; persistence of sugar *reduced* carbohydrate tolerance, and repeated fasting periods *increased* it. Prevention of glycosuria reduces the weight for a period, and abolishes ketonuria; later, on a similar diet, weight increases without acidosis and without injury to the Islands of Langerhans. Absence of sugar and ketones and hyperglycæmia increase

tolerance and protect internal secretion of ductless glands, especially of the pancreas and of the pars intermedia of the hypophysis and decrease kidney permeability.

Stillman, in an illuminating paper very recently published, has further analysed glycosurics with reference to that most dangerous complication, acidosis. Modern treatment has attempted control of acidosis on the discarded theory of Von Noorden that "fats burn in the fuel of carbohydrates." As Stillman has noted, rational treatment of glycosuria has been retarded by the accepted idea that "overfeeding with fat is harmless, and even beneficial, and that carbohydrate feeding is required to avert threatening coma." Excess of fat frequently *predisposes* to acidosis, as shown in a case under my care during the present season, whose diet on February 16 consisted of protein, 239 cal.; fat, 1,388 cal.; carbohydrate, 237 cal.; with sugar output 80·5 grm. in twenty-four hours, and urinary ammonia 1,696, more than five times the normal. On the following day the protein was reduced from 239 to 98 cal., the fat from 1,388 to 200 cal., and the carbohydrate from 237 to 142 cal., the greatest relative reduction being in fats. The result on the fifth day of this reduction was a fall of sugar to zero and of ammonia to normal, after which protein and carbohydrate were gradually increased, with fats to about one-half the original quantity, without development of sugar or increase of ammonia above normal.

Stettin's success with cases incipiently surgical in preventing advanced complications leading towards amputations was due, first, to exact and skilful medical direction, and second, to the most painstaking surgical care. It is a *duty* to call a competent surgeon at the very first sign of infection of any sort, especially of the lower extremities. Joslin notes that diabetics live for years on an atrocious diet, untreated,

without developing coma, until they are advised by some inexperienced medico to greatly increase the fats or decrease carbohydrates when coma promptly supervenes. Acidosis is not a product of carbohydrates, but develops from fats and protein, which in these long-standing cases act like poison; those patients tending toward acidosis should at first be deprived of fats, and its introduction to the diet made very gradually, since, though a valuable food, it cannot be metabolized until the system becomes adjusted to its use. Prior to fasting in such cases, Joslin wisely advises the not common plan of eliminating fat for some days from the dietary, then cutting out proteins, a factor of somewhat lesser moment for development of acidosis, but quite important enough. Reduce now quickly carbohydrates, halving each day for three days, and proceed to hunger days. Infectious cases while fasting should not be deprived of sodium chloride and should have abundant water, and if there be a tendency toward coma and vomiting, normal saline solution per colon should be constantly introduced by the Murphy method or by hypodermoclysis of salt solution. Small rather than large amounts of sodium bicarbonate are most efficient, half an ounce in twenty-four hours being usually sufficient; frequently *none* is required in the treatment of acidosis.

Absence of sugar, important as it is, becomes subordinate to the *control of acidosis,* which is associated with decreased blood alkalinity to the point of subnormal. Accumulation of hæmic acids, as pointed out by Stillman, neutralizes a portion of the normal sodium bicarbonate of the blood and, when advanced in an exaggerated degree, produces death. *Reduced excretion* of acids or *excessive production* are equally destructive of tolerance.

Excretion may be determined by urinalysis *when excretion is not impaired,* but *increased production* requires

more elaborate tests for determining over-production, or for faulty elimination due to decreased kidney permeability. The direct method of Van Slyke, from the blood, admits of estimation of blood retention, as compared with urinary excretion, and adds valuable data for prognosis and treatment, as also does the use of Haldane's apparatus, both, however, requiring considerable training for exactness.

Stillman divides fasting glycosurics, as regards acidosis, into four groups, and shows that the same individual may react at different fasting periods in an entirely different manner.

Group 1.—Represents cases with normal hæmic bicarbonate retention throughout, i.e., no acidosis, these being a good percentage of all cases.

Group 2.—Cases which, under fasting, recover from acid intoxication, even though at the verge of coma, which are less frequently observed.

Group 3.—Those cases show low acidosis, indicated by persistently diminished bicarbonate reserve in the blood and increased ammonia secretion.

Group 4.—Such rare cases as develop acidosis while fasting, though previously free.

Sydenham and Rolle many years ago demonstrated that diabetics are made sugar-free by an exclusively flesh diet, and, until Mosse determined that a wholly meat and fat diet induced coma, such continued to be the approved treatment. Bouchard, studying auto-intoxication, showed that the fæces of meat-fed animals were intensely toxic, as compared with vegetable eaters, as also did Herter. The bacteria of meat are putrefactive in type; proteolytic organisms, producing ptomaine and colon toxins. Putrefactive changes in the colon of the *residue of flesh* tend to irritation of the colon mucosa or to ulceration, and to non-resistance of the colon membrane to the absorption of toxins.

Falta states that "much meat is injurious to diabetics," animal protein having a higher percentage of purin bodies than vegetable protein, and this observation is confirmed by Allen. Falta says that some glycosuria patients are more sensitive to protein than to carbohydrates.

Graham Lusk, in a paper read before the New York Academy of Medicine within the month, gives it his opinion, as the result of observation and experimental work, that 4 or 5 grm. of nitrogen, i.e., 25 to 30 grm. of protein in twenty-four hours is sufficient for body needs in health for the average weight adult, and practically all that will be appropriated.

Von Noordon recognizes that a period of restricted diet, such as green vegetable days, raise the tolerance for carbohydrates, "provided no meat be given with them."

Klemperer, in cases of acidosis, advises vegetable days, followed by carbohydrates, with butter and eggs, "but no meat whatever." He says "meat spoils the results; even eggs may do so; vegetable albumen is well borne." The albumin of eggs in a small proportion of subjects in any condition produces a condition simulating anaphylaxis.

Naunyn finds the benefits of "hunger days" or vegetable days are dependent upon the exclusion of meat, and says "the general benefit attaching to all 'grain cures' is the exclusion of harmful foods, such as meat."

In Allen's judgment much of the benefit of the *oat diet* is due to the complete withdrawal of meat, in which conclusion Chittenden, Combe, Folin, Fisher, and many others agree.

Physiologists demonstrate that the function of protein is to replace wear of living tissues; that of carbohydrates, by their combustion, to maintain heat and muscular activity. As Kellogg aptly says, "Carbohydrate is the coal, while protein is the metal repair for the machinery."

I have, however, observed a patient for four months who had been meat-free for two years, with gradually increased tolerance for carbohydrates and reduction of sugar output to zero, who experimentally ate for one month, along with vegetable protein, 250 calories daily of chicken and bacon without return of glycosuria or acidosis, although the case had been one of a most obstinate character. In this exceptional instance appetite was lost for exclusively vegetable foods, and regained only by the addition of a modest amount of flesh diet. This case illustrates well effects of nervous strain upon the delicately poised glycosuric, as a week in New York without change of diet returned sugar from daily output of zero when the patient left to 46½ grm., ammonia from normal to ·23 per cent. reduced in three days to sugar 6 grm., ammonia 17 per cent. One must recognize that in this case mentioned tolerance had been established and health restored by low fats and moderate proteins, by regular "hunger days," followed on each occasion by two "green days," and slow return to moderate carbohydrate content. The sound maxim of Virgil, *in medio tutissmus ibis* requires much caution and judgment, in order to determine what *is* the middle course in which you will go safest, since that which is the middle course at one stage of any case may be wrong to the extreme at another. As in all other treatment of disease, hard-and-fast rules fail in diabetes, since one must in reason consider, not only the chemistry of the patient, but also the human element of psychological cooperation and physical appetite.

Benedict and Joslin have independently proved that the most advanced cases of diabetes retain some degree of power to burn carbohydrates, and Joslin has had no death in a mixed group of diabetics in 350 days under more or less prolonged intermittent fasting treatment.

Joslin has found among 912 cases, in which the immediate causes of death have been varied, 64 per cent. were associated with coma, and he states that coma can nearly always be foreseen and prevented by watching for acidosis, since the basic disease, diabetes, is chronic in character and offers ample warnings to the medical attendant, who is observant and wary. Ether anæsthesia would wisely be avoided; especially is the danger of coma increased in persons past fifty years of age on account of impairment of kidney elimination; general or acute local infections often add the final factor, precipitating coma. Speaking of infections of the legs, such as slowly advancing gangrene, Joslin deprecates delay in active treatment, and says: "Handicapped by a lingering infection, which only too often is allowed to continue for months, with kidneys less efficient for throwing off the acidosis attack; deprived of exercise—that recently proven stimulus to sugar consumption—these pitiful cases frequently meet a fourth enemy in ether anæsthesia, and is it any wonder that a formerly innocent disease becomes virulent and the victim dies of coma?"

Since the diabetic fails to a greater or less extent to metabolize starch and sugar, and since his ability to convert these into fat or to elaborate any form of food to the extent of one with healthy tissues is impaired, it is apparent that he must restrict both amount and quality of food below that taken in health by one of similar weight and height, and must restrict his exercise or work in proportion. The limitation of carbohydrates will be determined from time to time by the glycæmia and presence of sugar in the urine. Hyperglycæmia and urinary sugar do not run *pari passu*, since permeability of kidneys to sugar differs in different patients and at different times.

One-tenth per cent. glycæmia being normal, I have lately

seen at the sanitorium a patient whose hyperglycæmia was ·345 per cent., or nearly three and a half times normal, who was excreting only ·72 grm. sugar in urine in twenty-four hours; a second with blood sugar ·357 per cent., or practically the same, excreting daily 98 grm. of sugar. In the first case noted the sugar fell to zero on the third day of treatment, and the glycæmia in fourteen days was 122, i.e., within normal limits, and nearly three times less than at the beginning a fortnight earlier. Others I have observed with glycæmia nearly normal exhibiting sugar output of from 10 to 20 grm. daily, this difference manifestly depending upon some cause, which is, as far as at present known, varying permeability of kidneys to blood sugar. Such cases belong perhaps to the class known as "emotional" glycosurics, where kidney permeability is affected by overstimulation of the vagus acting upon adrenals, the so-called vagotonia, well described in Aaron's lately published book.

The system requires, even in diabetes, about 50 grm. (200 calories) of carbohydrates daily; the average man takes six or eight times this amount. The carbohydrate increase, measured in calories, must be begun at this low point and gradually raised, the rate being dependent upon, first, hyperglycæmia, and second, the appearance of glycosuria. Kellogg's graduated tables, based upon body weight, in use at the Battle Creek Sanitorium, reckoned upon standards of Chittenden, Lusk, and Folin, are a very convenient practical guide for feeding carbohydrates, fats, and proteins, increasing or decreasing each element as urinalysis indicates, as also are the diet cards employed by Folin, or Foster tables on a unit basis.

Lusk estimates the "base ration," i.e., the total intake for one at rest, to be 25 calories per kilo. body weight for maintenance of weight; 35 for one at labour. Thus in

Kellogg's tables for the diabetic, for each pound of body weight one should give in calories, beginning with carbohydrate ·5 cal., protein 1·5 cal., fat ·2 cal., and gradually increase, if sugar-free, up to carbohydrate 4 cal., protein $1\frac{1}{2}$ cal., and fat 10 cal. per pound body weight daily for a patient of the weight 130 lb., reaching this intake at about the end of two weeks, varying as required by weight and results.

Much detail is necessary in the successful care of the diabetic, but this treatment once appreciated becomes quickly simple, easily managed, and offers renewed courage and enthusiasm to both physician and the patient.

Dr. ANDERS: This is a very important subject, and I should like to emphasize one or two points in connection with the subject of the treatment of diabetes. It is fortunate that in diabetes we are getting away from the old method of giving only proteins at the start, watching the effect. I have been convinced that we cure only a small percentage of the cases in this manner, and, on the other hand, that we are exposing them to grave dangers. I have seen a number of disastrous results from a too exclusive protein diet, and from my own experience I should advise against it, especially in the more advanced stages of the affection. However, many patients will bear as much as 100 to 200 calories with apparently no ill-effects. I want to speak more particularly of my personal experience with the Allen treatment. In two recent cases in which this method was tried the sugar speedily disappeared without any ill-effect upon the general condition of the patients. In one of these cases acidosia had already occurred; and so far as a single instance can, it certainly does corroborate the value of this method of treatment. I am sorry that Dr. Smith did not give in detail Dr. Joslin's method of resuming carbohydrates and proteins. Whilst it is troublesome and there are many details to be kept in mind, still, so far as I know, Joslin's carefully prescribed rules for resuming the diet after the primary starvation period are the best we have at the present day. Commencing with 5 per cent. vegetables and going up to the 10 or 15 per cent. groups, it is not difficult to give the patient sufficient calories and at the same time not overtax his digestive organs. I feel that we are on the eve of a distinct advance in the therapeutic treatment of diabetes mellitus.

Dr. FREMONT SMITH: I shall simply add that I wish to emphasize the point in regard to the acidosis. The important thing is to watch for it. The case is not going to develop into coma if you know the acidosis is rising. You can check that. I have been seeing from fifteen to twenty-five cases a day for several weeks, and was responsible for their welfare. None developed acidosis—or coma rather—except one that came in, in coma, in the evening and died the following morning.

PULSATING SPLEEN IN MITRAL AND TRICUSPID DISEASE.

By MORRIS MANGES, M.D.
NEW YORK.

S. S., aged 16, entered Mount Sinai Hospital in November, 1910. She had been in the hospital one and a half years before on account of chronic endocarditis, double mitral disease with auricular fibrillation, which was rheumatic in origin.

At that time it was noted that the liver was tender and pulsating, and that the spleen was also large and tender. She left the hospital much improved; but one month later the old symptoms came back, and since then there had been more or less loss of compensation, on account of which she re-entered the hospital.

The physical status was that of advanced double mitral lesions with tricuspid regurgitation with a moderate dilatation of both ventricles. There was also a short localized diastolic murmur over the third space to the left of the sternum. An effusion in the right chest reached the angle of the capsula. The liver reached the umbilicus; it was hard, nodular, tender, and pulsating. The spleen was also enlarged, upwards and downwards, and almost extended to the umbilicus. It was hard and nodular; at the tip there was a large, firm nodule. The spleen almost reached as far as the liver, but it did not touch it, as a distinct space was felt between the two organs. No note was made of pulsation of the spleen at the time of admission.

The radial pulse was small, rapid, and irregular. The veins in the neck pulsated forcibly. The polygraph showed

auricular fibrillation. Systolic blood-pressure was 110 to 115.

The blood showed 6,700,000 to 8,000,000 red blood cells, 9,000 to 13,000 white blood cells, 90 per cent. polynuclears. Hæmoglobin 84 per cent. Urine showed a heavy trace of albumin and many granular casts.

The peculiar feel of the liver and spleen led me to suspect syphilis, although no history could be obtained. The Wassermann was strongly positive.

It was not until the patient had been in the hospital two weeks that the pulsation was observed in the spleen for the first time. It was probably present at the time of her admission, but it was not observed. It persisted throughout her stay in the hospital. It was a distinct expansible pulsation, which was best observed on bi-manual palpation, its time usually preceding that of the liver, but sometimes it seemed to coincide with it.

The course of the disease was that of any ordinary advanced endocarditis with an occasional infarct. She was in the hospital for a long time, and she left much improved, although when she left the fibrillation of the auricle and the pulsation of the liver and spleen were still present. Although efforts were made to trace her she was never heard from again. This report has been delayed in the hope of observing the case again, and also in the expectation of observing additional cases of pulsating spleen. However, in spite of systematic routine palpation of every enlarged spleen during the past six years I have been unable to find any additional cases.

It is to this feature of this case which I would call attention, since this is a symptom of very rare occurrence. It was first described by Tulpius [1] in 1652. Gerhardt [2], in 1882, reported a case in a man who had an old aortic regurgitation, and who also had malarial fever. Later on Gerhardt [3] was also able to report two additional cases of aortic regurgitation, in both of which pericarditis with fever developed during their stay in the hospital. In both of these cases he discovered pulsation of the spleen during the febrile stage of

the disease. He also noted that the increase in the size of the spleen was much greater than was usually observed under such conditions.

Prior [5] reported two cases. The first case was that of a well-compensated aortic regurgitation in which typhoid fever was contracted. The spleen only pulsated during the course of the fever. The second case was one of hypertrophy of the left ventricle, which was the result of over exertion in a workman, aged 37. Pulsation of the spleen occurred during the course of an attack of croupous pneumonia.

Drasche [6] reported a case of pulsating splenic tumour in a woman, aged 17, with an advanced aortic regurgitation which had appeared during the febrile stage of an attack of croupous pneumonia. The enlarged pulsating spleen disappeared as soon as the fever was gone.

To these cases which have been collected by Litten [7] I have been able to add two additional cases, both observed by Gerhardt [4]; both of these men had aortic regurgitation and developed the pulsation of the spleen during attacks of lead colic. In both cases the pulsation disappeared as soon as the attack of lead colic was over. Fever was present in one patient, and was absent in the other. In the former the liver also pulsated. No reference was made to the liver in the latter case.

With the exception of the historic case of Tulpius which he observed in 1652, all of these cases were observed within the period from 1882 to 1888. I have been unable to find any cases after this date. A striking commentary on how the careful clinical examinations have been lost since the laboratory has played such a preponderating *rôle* in the making of diagnoses.

In all of these cases the splenic pulsation was arterial and was synchronous with the cardiac systole, and increased

and diminished with the vigour of the cardiac action. Prior's two cases showed this very strikingly; in the pneumonia patient the pulsation seemed very much less during the period of cardiac weakness, and it also almost disappeared as soon as the spleen decreased in size when the fever was gone. In the two cases of lead colic, it was only present during the period of very high blood-pressure associated with the colic.

According to Gerhardt and Litten three factors are needed: An enlarged spleen, chronic cardiac disease, and an acute febrile disease. The chronic cardiac disease always represented a marked hypertrophy of the left ventricle usually with aortic regurgitation; only once was there idiopathic hypertrophy of the left ventricle. The fevers included pneumonia, malaria, and typhoid fever. Litten explains the phenomenon as being the result of the fever increasing the vascularity of the spleen and relaxing its tissue. As a result the pulsation of the arteries is transmitted more readily and distinctly through the organ. This explanation does not hold in the two cases of lead colic. Here Gerhardt assumes that a high blood-pressure associated with the lead colic makes the pulsation in the splenic vessels more forcible.

The present case differs from those thus far reported. There was no evidence of aortic regurgitation, unless the short diastolic murmur in the third left space might be accepted as evidence of aortic regurgitation, of which, however, there was no other symptom, and there was no Corrigan pulse or double tone in the vessels; the tracings showed no sign of it; the hypertrophy of the left ventricle could easily be explained by the mitral lesion.

How can it be explained? Surely not according to Gerhardt and Litten, for most of the conditions postulated by them are absent; there was neither fever nor acute infectious disease, and there was no aortic regurgitation.

There was an hypertrophy of the left ventricle, and there was an enlarged spleen. The hypertrophy of the left ventricle was mitral in origin; the splenic enlargement was partly due to the cardiac disease and partly to the syphilis. There was no evidence of aneurism or any pulsating vascular tumour.

The question at once arises whether the pulsation may not have been transmitted from the heart, liver, or the aorta. This may be dismissed, because the pulsation was distinctly expansile and independent of any of the other viscus. This could readily be demonstrated on bi-manual examination. There were no pulsating tumours or cysts of the spleen, and the pulsation must have originated in the splenic vessels. This was well illustrated by a series of tracings which were made by Dr. Alfred E. Cohn. The tracings include the time relations of the spleen to the liver, cardiac apex, radial and femoral arteries. These tracings were studied by Dr. Cohn and Dr. B. S. Oppenheimer. It is not an easy task to draw conclusions from them, as unfortunately no jugular or abdominal aorta tracings were made. Dr. Cohn was inclined to regard the splenic pulsations as arterial. The pulsations in the liver he considers to be of the ordinary ventricular type. Dr. Oppenheimer, after a careful study of the tracings, is unable to reach any positive conclusions concerning the nature of the splenic curves. He agrees with Dr. Cohn in considering the liver pulsations to be ventricular. When two observers who have had such a large experience in interpreting tracings are unable to agree, I believe it will be wisest to simply state the findings and to leave their exact determination to the future, when possibly more cases will have been observed. The following are the time relations:—

(1) The cardio-hepatic time is ·022 second.

(2) The cardio-splenic time is ·09, or 1 second.

(3) The cardio-femoral time is ·1 second.

These figures would indicate that splenic pulsations are arterial, since the time relation of the femoral artery agrees so closely with that of the spleen. The dynamic conditions which exist in this case, however, do not warrant this assumption, as this conclusion would predicate the existence of an aortic regurgitation, of which there are almost no evidences. The only possible warrant for it might be the short diastolic murmur in the third left space. This is not enough for the diagnosis of aortic regurgitation, all the evidence of which was absolutely lacking, although it was carefully sought during the long period she was under observation. But even if we did assume it to be present, all the other postulates of Gerhardt and Litten are absent. To assume that the pulsation in the spleen is arterial and that that in the liver is venous is an improbable assumption. The most plausible explanation is to attribute both pulsations in the liver and the spleen to the same source, i.e., venous, for this is the type usually seen in tricuspid regurgitation. This, too, is improbable, for it is inconceivable that the pulsations in the liver, which are so closely related to the inferior cava, should also be propagated into the splenic vein, which is a branch of the portal vein.

It is greatly to be regretted that I can offer no explanation of this unique case. Unfortunately, it is the only case of the kind which has ever been reported, and it was observed six years ago when the cardiographic methods were just being inaugurated.

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PATENT DUCTUS ARTERIOSUS WITH INFECTIVE PULMONARY ENDARTERITIS.

By MORRIS MANGES, M.D.
NEW YORK.

Mrs. R. B., aged 32, housewife, entered Mount Sinai Hospital on October 21, 1915.

Previous history negative, except a severe grip fifteen years ago. No tonsillitis or rheumatism. She always considered herself well until eleven years ago, when, at the time of her marriage, she applied for life insurance, and to her surprise she was rejected because of heart disease. She had had no cardiac symptoms then or as a child. She had borne two children, which are now 5 and 3 years old; there were no cardiac symptoms during pregnancy or labour.

Present History.—For the past three months she has had fever and chilliness; there were also vague joint pains, cardiac palpitation, and increasing weakness.

Examination showed a slight cyanosis. The heart was moderately enlarged to the right and to the left, the right border being just beyond the right sternal border; the left border $4\frac{3}{4}$ in. to the left of the mid line. Apex normal. There was a Gerhardt dulness in the first and second left spaces reaching $\frac{1}{2}$ in. from the left sternal border. At the apex there was a soft systolic blowing murmur; in the second left space and transmitted into the vessels of the neck there was a loud, rumbling systolic murmur which ran into the diastole. The second pulmonary sound was sharply accentuated. The lower border of the liver was one finger's breadth below the costal border; the spleen extended to 2 in. below its costal border. Around both legs there was a crop of small petechiæ.

The blood examination showed 5,500,000 red blood cells, 9,000 white blood cells, 87 per cent. polys., 60 per cent. hæmo. Wassermann and Widal were both negative.

Blood culture showed a non-hæmolitic streptococcus (*Streptococcus viridans*).

Blood-pressure.—Systolic 105, diastolic 60. Urine: Trace of albumin, no casts, and no red blood cells.

The fluoroscopy (Dr. Wessler) showed a heart which was normal in size and position. The pulmonary artery was considerably enlarged and pulsated vigorously. The aorta normal. The diagnosis was enlarged pulmonary artery, which was characteristic of patent ductus arteriosus.

The electrocardiagram showed no abnormality. There was no evidence of congenital lesion, such as extraordinarily tall R waves or predominant hypertrophy of right ventricle (Dr. B. S. Oppenheimer).

During the first two weeks of her stay in the hospital she ran an irregular temperature of 99 to 102 degrees. Then on November 2 and 3 it ranged between 103 and 104 degrees; it was somewhat lower for the next four days; then it rose to 105 degrees. From November 10 to her discharge from the hospital it ranged from 99 to 102 degrees.

Later blood counts showed from 7,800 white blood cells with 53 per cent. polys., to 15,000 with 79 per cent. polys. The average counts were from 8,000 to 9,000.

The murmur became louder and more rumbling, and gradually occupied all phases of the cardiac cycle. The second and only other crop of petechiæ developed two months after the first group and was not very abundant.

Two additional blood cultures were taken. The first was negative, but the second was again positive.

At no time did she seem to be very ill, except at the short period of high temperature, and when she had a large infarct of the left lung on December 25. After a three months' stay she left the hospital somewhat improved. Her present condition is unknown, as all efforts to find her have been unsuccessful.

This case is of interest not alone because of the rarity of infective pulmonary endarteritis, but also on account of a number of points which are of practical importance.

(1) The occurrence of patent ductus arteriosus and infective endarteritis is a very rare one. Hamilton and Abbott [1], who have collected the literature up to 1914, have been able to gather ten cases, and have reported a case of their own. Dr. Libman has informed me that he has observed two cases (both without autopsy) which he will publish elsewhere. The present case brings the total number up to fourteen.

Although there is no post-mortem evidence to prove the diagnosis in this patient, the history and physical signs warrant the diagnosis of infective pulmonary endarteritis. There was no evidence of infective endocarditis, unless we assume that the soft systolic apical murmur indicates involvement of the mitral valve. The murmur was not constant, and its character and the other systolic signs do not warrant the diagnosis of endocarditis. All the cases of infected endocarditis which I have observed have not presented such a slight variable murmur. The large pulmonary infarct would have been a very unusual occurrence in an uncomplicated mitral endocarditis, because such an embolus would have lodged in the greater circulation. One is therefore justified in assuming that the pathological findings in this patient are identical with those which are so well described and illustrated in Hamilton and Abbott's article.

That infective pulmonary endarteritis should occur in congenital cardiac lesions is by no means surprising, as the conditions which favour a bacterial infection are identical with those which exist in the hearts and vessels in acquired endocarditis and endarteritis. That the number of cases of bacterial infection in congenital cardiac diseases should be largest in patent ductus arteriosus is readily explained by the fact that, of all the congenital lesions, patent ductus arteriosus is the one which is most conducive to longevity, as will be referred to later on.

The clinical features agree in nearly all ways with the case reported by Hamilton and Abbott. The special points of diagnosis are well summed up by Hamilton and Abbott, in whose paper the literature of the subject, together with an analysis of the cases reported, will be found.

(2) The mild course of the disease in this case.

This was a striking feature; during the long period of observation she did not seem to be very ill, and often she was kept in bed with difficulty. It was only when she had the rise of temperature to 104-5 degrees, and also when she had a pulmonary infarct, that she was willing to consider herself sick. Hence, unless one is on the watch for such possibilities the diagnosis may readily be missed. The only showers of petechiæ which she had were two in number, and these were scanty and only on the legs. This will also explain the absence of red blood cells in her urine. In doubtful cases, where the blood culture is negative, the presence of red cells in the urine may be of considerable corroborative value.

I would also direct attention to the course of the fever and the low blood counts in this case. For the greater part of the time the fever was low and below 102 degrees. A low grade of fever without chills does not exclude the possibility of the existence of the *Streptococcus viridans* in the blood. Hence the rule which has been followed in Mount Sinai Hospital to take blood culture in all cardiac patients who run even low temperatures. A number of cases of infective endocarditis have thus been discovered where the clinical course would not have led one to suspect its existence.

The blood count ranged from 7,800 to 10,400, and only once did it rise to 15,000. The polynuclear count was also low, ranging from about 53 per cent. to 80 per cent.

(3) The diagnosis of patent ductus arteriosus in adults.

I believe these cases are much more common than is usually suspected, though Abbott [2] claims that as an isolated lesion patent ductus arteriosus is among the more infrequent of cardiac anomalies. To too many physicians the diagnosis of congenital cardiac disease is improbable, unless there are more or less cyanosis, dyspnœa, and clubbed fingers, as well as a history which goes back to early childhood. Nothing is further away from the real condition than such a view. If such symptoms were present to any degree in childhood adult age would never have been reached, for these children usually succumb to some intercurrent disease. The present case shows how erroneous this view is, and my experience in quite a number of other cases of congenital cardiac disease which I have observed in adults corroborates this statement. I will cite only four cases.

The first case was that of a married woman, aged 35, who was admitted for a diffuse adenocarcinosis of the stomach with peritoneal and intestinal metastases and ascites. The physical examination revealed a patent ductus arteriosus, but she had never had cardiac symptoms of any kind, and, although she had to be tapped many times for the marked ascites due to her cancer, her symptoms were in no way aggravated by the cardiac lesion.

The second case was a woman, aged 30, with patent ductus arteriosus and Basedow's disease. Until the onset of the Basedow's disease five years before her admission to the hospital she had never had any palpitation of the heart or cardiac symptoms.

The third case was a woman, aged 50, with patent ductus arteriosus. She entered the hospital for an attack of sciatica. She had never had any symptoms until two years ago. These were not marked, however, and the only complaint that she made during her stay in the hospital was of a slight dyspnœa and a moderate œdema of the feet.

Another of the congenital lesions in adults is coarctation of the aorta, a very marked example of which I would refer to in a man, aged 58, who died from a new growth of the

lung. He never had any symptoms which were directly referable to the circulatory system, and yet, at the autopsy, a very marked coarctation of the aorta was found.

When the congenital lesions exist singly without any other complicating congenital defect very few circulatory symptoms are present, the only evidence of them being the physical signs.

The diagnosis of patent ductus arteriosus may readily be made by the following Hochsinger's [3] rules :—

(1) Palpable and much accentuated second pulmonic sound.

(2) Gerhardt's sign.

(3) Thrill felt in the jugulum.

(4) Enlarged pulmonary artery in the X-ray picture.

(5) Murmur in second left intercostal space, which in infancy is always systolic in uncomplicated cases, but as dilatation from the pulmonary artery develops, may extend into the diastole.

(4) Cardiac Disease and Pregnancy.—This patient also brings up another point of the greatest practical importance. I refer to the fact that this woman with a marked congenital cardiac lesion bore two children, and went through both her labours without any trouble whatsoever. This is also true of two of the other cases of patent ductus arteriosus which have already been referred to. One, the case of the woman with the adenocarcinoma who bore two children, and the other, which is most striking of all, the woman, aged 50, who, in spite of her patent ductus arteriosus, had borne eight children and had also had three miscarriages, all without manifestations from the heart !

What is true of these women with congenital cardiac disease is also true of acquired cardiac disease, viz., the case

with which children are borne by these patients. I make this statement as the result of having paid particular attention to this question during a long hospital experience. I have always inquired of the women who were admitted to my service with cardiac lesions and who had borne children whether there had been any unusual trouble during the pregnancy or the labour. Usually the answer came in the negative; indeed, they seemed to be surprised that such a question should be put to them. Further corroboration of this statement is to be found in the fact that most of these women had borne two or more children. I know of one case of a woman with valvular disease who had borne eleven children without any discomfort from her heart.

There is only one lesion which gives trouble, namely, mitral stenosis, and this is true only in the uncomplicated type. When there is an associated mitral regurgitation no great difference is reported in the pregnancy or the labour. That the addition of the mitral regurgitation to the mitral stenosis should ease the cardiac condition is self-evident.

I cannot bring any statistical data to prove these statements, as I have never tabulated these cases. A fact definitely stated as being based upon twenty-three years' experience in an active medical service is more convincing than any array of figures. This experience is so opposed to the general teachings that it would be a matter of interest to have this point discussed to-day.

A striking illustration of the prevailing views as to the dangers attending labours in congenital cardiac lesions is provided by Rosenthal [4], who reported the case of a woman with patent ductus arteriosus upon whom a Cæsarean section was performed, so great were the fears that the woman would not be able to go through her labour. Up to the time of labour she presented no untoward symptoms; but, as soon

as labour set in, the Cæsarean section was performed. This operation she bore as a normal individual would have. She made an uneventful recovery.

I wish to add that these views in regard to cardiac women refer to hospital patients. In private practice my experience has not been the same. I have not seen so many pregnant cardiac women, as the prevailing views in the profession do not encourage such women to marry or to have children. If, perchance, they do become pregnant, an abortion is too often advised. The poor patients whose lives have not been made miserable by the chance finding of a murmur, and whose compensated hearts have not been so needlessly and harmfully disturbed and coddled by over solicitous physicians, usually fare better than their rich sisters.

I would not be misunderstood by being too sweeping in my remarks. What I urge is that compensated hearts (uncomplicated mitral stenosis excepted) should be regarded in a much more favourable light as regards marriage and pregnancy than is now the rule.

[1] HAMILTON and ABBOTT. "Patent Ductus Arteriosus with Infective Pulmonary Endarteritis," *Trans. Assoc. Amer. Phys.*, 1914, vol. xxix, p. 294.

[2] ABBOTT, OSLER and MCCRAE'S "Modern Medicine," second edition, vol. iv, p. 342.

[3] HOCHSINGER. "Zur Diagnose der Persistenz des Botallischen Ganges und der Erweiterung der Lungenarteterie," *Wiener Klinik*, 1907, p. 311; also WESSLER and BASS, "Persistent Ductus Botalli and its Diagnosis by the Orthodiagraph," *Amer. Journ. Med. Sci.*, 1913, vol. cxlv, p. 543.

[4] ROSENTHAL. *Amer. Journ. Obstetrics*, 1913, vol. lxviii.

DISCUSSION.

Dr. THOMAS: I did not hear the first part of Dr. Manges' paper, but the last part recalls to mind a condition which I have observed in two cases in recent years, with involvement of the pulmonary valve

and artery. One of these was a man who came into the hospital with fully developed typhoid fever, who had been given a preliminary examination by a man not connected with the hospital but in whose ability as a diagnostician I had perfect confidence, and who had said there was no lesion of the heart. This patient had a typical typhoid fever, and later during the convalescence developed a marked lesion of the pulmonary orifice, with all the decided symptoms of pulmonary valve lesion. This is a very uncommon case, and was also extremely interesting because of the rare connection between endocarditis and typhoid affection. Several cultures of the blood were made, from which it was impossible to get any growth at all. The patient left the hospital with the lesion still existing but with no signs of the acute infection. I should say, however, that after the typhoid fever had run its course there was a mild infection indicating some involvement of the heart. I am inclined to agree to a certain extent with Dr. Manges's remarks concerning heart lesions with pregnancies; but I think that a great deal more dependence can be placed on the complications in these cases (kidneys, arteries, &c.). Whether any move should be taken to bring about abortion in these cases, I think, depends to a great extent upon the condition of the kidneys and arteries. Three years ago I reported a case to this Society of recurrent laryngeal paralysis following mitral stenosis. I should simply like to state in connection with that case that the patient has since married and become pregnant, and that it was absolutely necessary to end the pregnancy at the two months' period, as the signs of loss of compensation of the heart became marked at that time.

Dr. JACOBI: I have always been under the impression that pregnancy and heart disease did not agree, and I have not been cured of that prejudice, if it is such, even by Dr. Manges' paper. As a rule, heart disease in pregnant women is not uncomplicated; there is always an endocarditis complicated by a mild carditis. In the end these cases are always in danger, and it is my belief that they will never be able to carry out their pregnancies to their own advantage or to the advantage of the child. What I am particularly interested in is the diagnosis of the patent ductus arteriosus. I do not find it very often in adults. A few years ago a man well known in our medical literature wrote a paper—a good paper—on the subject of "Diagnosis and Treatment of Patent Ductus Arteriosus." But the true symptom—and that is what you and I are interested in—he did not mention at all. He told me afterwards that he had not paid any attention to that symptom. Therefore, I will, just in a minute or two, tell you how to diagnosticate in a baby the symptoms of ductus arteriosus patent. These hearts are not increased in size. They appear to be normal unless you examine them carefully. There is seldom any increase of percussion dulness over the ventricles, but with a very delicate touch, and close examination, you do find a murmur, and that murmur is pul-

monary. It is found in the carotids of both sides, and ascends all the way up and along the left margin of the sternum. Very gentle percussion will show this dulness. But it is difficult to teach the student to be gentle in his percussion. Over the chest the percussion should be very gentle, and there you will invariably find a dulness along the left edge of the margin all the way up, and not infrequently more murmur in both carotids even than in the pulmonary artery. That is all I care to know about the diagnosis. It is easily made if you teach your students to be very gentle in their percussion, and to hold very close to the old rule that the finger must be in the same position on the right side as on the left. These patients may die at an early age, or they may live to an advanced age. I have in mind a case I saw when the boy was only a few months old and who is now 15 or 16 years old. He has been cured by the coagulation of the blood in the open ductus and shrining of the artery for two or three years, and is now perfectly well. He has had the fortune of living in a fairly well-to-do family and has been kept away from over-exertion. He has had no treatment except frequent doses of a mixture of digitalis and strophanthus. He has taken when a small boy two or three drops—afterwards five or six drops—of that mixture in equal parts three times a day after eating, and that is all the medication he required. These are the points I would insist on in diagnosticating the patent ductus arteriosus.

Dr. MANGES: I am not making a plea for women with cardiac disease to be allowed to marry. I am simply stating an experience of twenty-three years' of careful observation of women with cardiac disease who have come into my service and who have borne children. You may state that I have not included those who did not survive, as they could not be admitted to the hospital. But the number has been so large and the number of children so considerable that I think it is time possibly for us to revise some of the opinions that now exist—that we should take a more generous view. We have revised our views in regard to other things, and I believe that an experience of this kind, of one observer, may lead others to make a study of this question, and that possibly we may help these poor women in this way to lead more happy and more useful lives.

ACUTE LOBAR PNEUMONIA AND ANATOMY OF THE LUNGS.

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At the outset let it be understood that this paper presents an hypothesis—an exercise of the imagination, which, taking certain facts as they are or as they are accepted as being, attempts to construct a scheme or system wherein the various facts or assumed facts considered shall bear causal relations to one another.

If any justification be required for presenting such a paper, it may be observed that progress in knowledge is as dependent upon the exercise of the imaginative powers as it is upon the use of the experimental faculties—imagination and experimentation must co-operate and correlate. The value and importance of this proposition was pointed out many years ago by Tyndall in what he aptly called the "scientific use of the imagination." Even where the imaginative is shown not to be true, it works in the long run for the general advancement of science. As an illustration of the indirect benefits of the imaginative may be mentioned Prout's hypothesis regarding the ultimate constitution of matter—namely, every element but a different multiple of hydrogen. In itself this hypothesis contained nothing that was either true or usable, but, in the incentive it gave to efforts to establish or disprove its validity, it led to the

finding out of so much else that was true that but few, if any, other ideas have borne more fruit—of real additions to our knowledge—than it has borne.

It is the purpose of this paper to present for consideration and criticism in the form of a proposition certain ideas arising from a consideration of some of the characteristics of acute pneumonia considered in connection with the anatomical structure and relations of the lungs, and to endeavour to show how this disease may be profoundly influenced by, if not ultimately dependent upon, the mechanical factors involved in the physical structure and relations of the lungs, once the adequate initial impulse be imparted to set the pathological machinery in motion.

In order that the correlation of the facts to be presented and the deductions made therefrom and embodied in hypothetic form may be the more readily followed and criticized, I shall state briefly the proposition that I hope to establish as a plausible, if not reasonable, hypothesis before presenting the facts and other considerations that led to its formulation :—

The hypothesis is, briefly, that acute lobar pneumonia is inaugurated, in the greater number of instances, by an abnormal deficiency in the parenchymatous blood supply of the lungs coincident with the presence of the potential bacterial organisms. This abnormal deficiency results from mechanical interference caused by the pressure of enlarged glands upon the bronchial or pulmonary arteries, or both, and that the vessels most frequently so pressed upon are the bronchial arteries.

This hypothesis, as stated, is not offered as applying to all cases of acute lobar pneumonia. It may, however, be made general by substituting for the specified cause, enlarged glands, any condition that would mechanically interfere with

the parenchymatous blood supply of the lungs. The naming of a specific cause was deliberate because, first, it seemed the most likely and therefore frequent one to interfere with the blood supply, and secondly, because, if true, it would emphasize the clinical importance of a generally neglected but extremely common condition: lymph-glandular inflammations so frequently, if not universally, prevalent in the common colds, sore throats, and other apparently mild and inconsequential affections of the respiratory and upper alimentary tracts.

Having stated the hypothesis, it is in order to see how it will apply in the light of our present knowledge to the disease in question. It is therefore necessary to review the current and accepted theories, facts, and other considerations involved, etiologically, pathologically, and anatomically. This will be done as briefly as consistent with clarity.

The accepted etiology of acute lobar pneumonia is that it is primarily a disease of bacterial causation, the exciting cause in most instances being the *Diplococcus pneumoniæ*. Certain conditions of life and circumstances are regarded as more or less important predisposing causes or factors; these are age, sex, race, social and personal conditions, previous attacks of the disease, trauma, undue exposure to weather, and season and climate. How these several factors influence or are related to the incidence of the disease may be briefly and somewhat synoptically stated as follows:—

(1) In adults the pneumonia incidence increases with age. The disease is also of frequent occurrence in children under 6.

(2) Pneumonia is more common in males than in females; but in prisons, where the conditions of exposure are identical, the incidence is alike in both sexes.

(3) It is more common in outdoor workers than in indoor workers, and in those whose occupations expose them particularly to cold and wet,

(4) One attack predisposes to subsequent attacks.

(5) Trauma of the chest has often been followed by pneumonia.

(6) Pneumonia is said to be more fatal in negroes than in whites.

(7) In the temperate zones pneumonia is decidedly more prevalent in the coldest months of the year.

It is quite obvious that, these factors are so general in their application that applied to explaining the incidence of an individual case they have but little significance. It is only in the statistical investigation of a series of cases that their influence becomes apparent and their application valuable and pertinent aids in searching for more definite etiological agencies. The *Diplococcus pneumoniæ*, as previously stated, is the most frequent cause of acute lobar pneumonia, though other germs occasionally give rise to the same pathological phenomena.

Whilst the most frequent bacterial cause of pneumonia, the diplococcus is a quite common cause of inflammation in other tissues and portions of the organism. Park,[1] quoting Netter's statistics as authority, reports the percentage of different diseases in adults caused by the pneumococcus to be as follows :—

Pneumonia	66 per cent.
Broncho-pneumonia	16 ,,
Meningitis	13 ,,
Empyema	8 ,,
Otitis media	2 ,,
Endocarditis	1 ,,

And in forty-six consecutive pneumococcus infections in children the diseases produced were :—

[1] Park and Williams : "Pathogenic Micro-organisms," fourth edition, New York, 1910, p. 388.

Otitis media	29 cases
Broncho-pneumonia	12 ,,
Meningitis	2 ,,
Pneumonia	1 ,,
Pleurisy	1 ,,
Pericarditis	1 ,,

From the frequency with which other parts and organs are attacked by the *Diplococcus pneumoniæ*, we are justified in stating that, so far as the germ itself is concerned, it is indifferent as to the locus invaded, and that one part of the body is as suitable a nidus for its growth as another, once the essential conditions for its pathogenic development be established. *The prime essential appears to be the establishment of such local conditions as favour the rapid growth and development of the bacterium.* It may be well to state here that pneumonia is regarded as a general disease, but one with a remarkably localized lesion or, perhaps as better conveying the conception, a disease that is essentially local in its anatomical manifestation, but general in its functional effects.

Notwithstanding that the *Diplococcus pneumoniæ* does cause most serious disease, it is not, generally speaking, virulent to man—that is, to civilized man. Observers have repeatedly found it in apparently healthy throats. The New York Pneumonia Commission found from 80 to 90 per cent. of normal individuals harbouring active pneumococci in their oral secretions. Many instances are of record wherein the pneumococcus was a continuous inhabitant of certain throats. That such germs were virulent to susceptible animals has been repeatedly established, and by presumption they were virulent to man should the other conditions necessary for their pathogenic activity have been present. Further, it has been demonstrated that pneumococci may pass through the mucous membrane of the mouth, tonsil, pharynx, and respiratory tract, and that this passage may be accomplished

without eliciting any evidence whatever of their presence. Relative to the ability of the diplococcus to initiate an attack of acute lobar pneumonia, as Adami[2] well expresses it, "Whether pneumonia is produced or not must depend, therefore, upon some second cause, either increased virulence of the bacteria or diminished resisting power on the part of the organism." From what is known of the life-history of the germ, Adami is not inclined to think that increased virulence of the diplococcus need be considered. And somewhat to the same purport Osler[3] observes that "In the great majority of cases it [pneumonia] is an auto-infection, and lowered resistance due to exposure or to alcohol, or to a trauma or an anæsthetization, simply furnishes the conditions which favour the spread and growth of an organism already present." The variability of the pulmonary locus would appear also to bear out the idea, generally speaking, of the avirulence of the pneumococcus in normal man, and of the necessity of its being assisted by some rather unusual extraneous influences. As relevant to this, and as summing up our present knowledge of the etiology of pneumonia, I shall quote again from Adami as follows: "It is perhaps difficult to account satisfactorily for the variability in the distribution of the lesions. . . . The explanation probably is that the *Diplococcus pneumoniæ* being relatively non-malignant in man can only act in the event of a *locus resistentiæ minoris* being formed, and this in ordinarily healthy people is apt to be present in only one portion of the lung."

What is or are the commonly acting cause or causes bringing about a *locus resistantiæ minoris* in only a

[2] Adami: "Pathology," second edition, New York, 1912, vol. ii, p. 299.

[3] Osler: "Practice of Medicine," eighth edition, New York, 1912, p. 98.

portion of the lung, as a rule, have not been satisfactorily explained as far as I know. Apart from trauma to the lung (and this only accounts for traumatic pneumonia), I do not recall that any specific explanation has been advanced which would account for a localized area of lessened resistance. It is true that the predilection of the disease for the right lung and lower lobe of the right lung has been attributed to the larger size and less angular deviation of the right bronchus from the line of the trachea, as compared to that of the left bronchus, permitting the entrance of foreign material more readily into the right lung, thereby causing obstruction, &c. Considering the perfect elasticity of the inspired air giving equal directive velocities into all the primary bronchi; the moist and very angular passageway traversed by the tidal air; the minute size of the infective organism depriving it of directive momentum; the effect of the ciliated epithelium of the respiratory tract; and the minimal infrequency of any evidence of such obstruction by foreign matter; all in the light of the anatomical differences of calibre and angularity, this explanation may be put aside as embodying negligible etiological factors. The limits of this paper will not admit of a more detailed exposition of its inadequacy. It is pertinent at this point to refer to the information added to our knowledge of the life-history of the pneumococcus by the investigations and researches of recent workers. Without going into particulars, it appears that the pneumococcus is not always of one strain, so far as virulence is concerned; that, on the contrary, there are certainly several strains of varying degrees of pathogenetic powers. There is also some recent evidence that the virulence of the pneumococcus can be either increased or decreased, and, likewise, that germ is endowed with pleomorphic faculties that can be developed

according to the environmental conditions, &c., to which it may be subjected. Our knowledge is yet far from being certain and complete regarding the life-history of the pneumococcus, and our present conceptions may be materially modified or changed by future discoveries. However, what is yet lacking need not of itself deter us from seeking to find if any special conditions of the host are necessary to the development of the disease under consideration. Assuming that there be established the fact of pneumococcic strains of always high pathogenicity to man, such as indicated by the researches of Dochez,[4] Gillespie, Avery, and others, there will yet remain to be explained why these strains of coccus manifest themselves in the peculiarly characteristic manner they do in acute lobar pneumonia, and that is the purpose of this paper.

There are certain pathological facts in the incidence of pneumonia that must be mentioned, and which are obviously so characteristic of the disease as to be inseparably associated with it, and must be accounted for or considered in any satisfactory etiological explanation of the disease. These facts, somewhat briefly stated, are as follows:—

(1) The right lung *only* is involved in a little more than 50 per cent. of the cases; the left lung *only* in about 30 per cent.; and *both* lungs together in about 20 per cent. of the cases.

(2) In adults the basal portion of the lungs is more often involved than the apex in the ratio of 3 to 1.

(3) In children under 5 years more than 40 per cent. of the cases are apical, and the right apex is twice as often involved as the left.

(4) One lobe only is involved in 40 per cent. of the cases

[4] Dochez and Avery: *Journ. of Exper. Med.*, 1915, vol. xxi, p. 144.

two lobes in 40 per cent., and three lobes in about 20 per cent. of the cases.

(5) The most frequent combination when two lobes are affected is the two bases.

(6) The bronchial glands are always enlarged and swollen.

Less well accepted or authenticated are the following :—

(7) The region of the root of the lung is less frequently involved than other parts.

(8) The central part of the involved lobe is in a more advanced stage of the disease than the peripheral parts of the same lobe—that is, the locus of involvement appears to have begun about the smaller bronchi and extended radially therefrom, as it were.

The morbid anatomy of the diseased lung need not be reviewed. The anatomical structure and relations of the organs will now be recounted as concisely as is consistent with the subject under consideration.

Embryologically considered, the lungs are derived from an evagination of the entoderm of the ventral wall of the upper portion of the primative fore-gut of the embryo. As development progresses this evagination elongates caudally and expands laterally. It very soon develops two diverticula, one pouching to the right and one pouching to the left. These diverticula grow and protrude into the thoracic celom and its mesenchymal tissue on either side of the esophagus, carrying the endothelial lining of the cavity before them, and from which later the pleuræ develop. They soon show vesiculation, the right diverticulum developing three vesicles, the left two, the rudiments of the future lobes of the lungs. These vesicles almost at once manifest buds or bulbous protrusions from their walls, which grow, branch, bud, rebranch, and rebud until the complete bronchial tree, as it may be called, is developed. The last

or ultimate buds develop and remain as a number of small cellulated saccules, the alveolar sacs, connected by sacculated tubules, the alveolar ducts, to somewhat less sacculated tubules, the respiratory bronchioles, which themselves have sprung from somewhat larger tubules, or bronchioles; and so on from a succession of increasing tubules and tubes, the bronchioles and bronchi of different orders, according to calibre, to the main stem, the trachea. These ultimate buds constitute the essential respiratory lung units or lobules. While these changes in form and relations have been taking place, certain changes in the character of the original entodermal cells have also come about; those in the trachea, bronchi, and bronchioles, as far as the beginning of the respiratory bronchioles, have become cylindrical or cuboidal and ciliated, and those of the respiratory bronchioles and air sacs have become extremely thin and flattened, the so-called pavement variety. Some few granular polygonal cells, however, are to be seen scattered in the respiratory bronchiole and the immediately contiguous air-sac area. Thus the entire functional part of the lung is developed from the entoderm. The other structures found in the lung make-up —namely, the vascular, glandular, and supporting tissues all come from the mesenchyme, into which the original entodermal evagination pushed its way.

The histology of the lung, including the trachea, will call for but brief mention. The character of the essential cell lining of the air-tubes and the air-sacs has already been sufficiently described. The walls of the trachea and the bronchi are composed of a fibro-elastic membrane in which cartilaginous segments and discs are imbedded, internal to which is a layer of unstripped muscular tissue circularly arranged. Considerable elastic tissue and many acinous mucous glands are to be found in the submucosa, and in the

tracheal mucosa a great deal of lymphoid tissue abounds. In the trachea and primary bronchi the muscular walls are incomplete ventrally, and the cartilaginous walls, consisting of ring segments, are incomplete dorsally. In the secondary and smaller bronchi and the bronchioles the muscular fibres, which may be traced as far as the atria of the air-sacs, encircle the tubes completely. The fibro-cartilaginous walls of the secondary and small air-tubes consists of discs and plates instead of ring segments so disposed as to surround the air-ducts, rendering them more or less rigid and patent. These cartilaginous deposits, however, progressively diminish as the air-tubes decrease in size, until in bronchioles of 1 mm. diameter they disappear altogether. The lung units, or lobules, are approximated to each other in the order imposed by their branching from the general bronchial tree system. Between the lobules, the pulmonary and bronchial vessels ramify and the lymphatics take origin. On the walls of the air-sacs the branches of the pulmonary artery break up into the pulmonary system of capillaries. In the growth of the lungs, the parts developing from the primary vesicles are marked off by certain clefts in the periphery; these clefts, deepened, as it were, by the continued growth of the organs, eventually divide the lungs into the so-called lobes. *So far as the general structure and arrangement of these lobes are concerned, they are identical the one with the other.*

The gross anatomy of the lungs will be taken up only in so far as it appears to bear upon the subject under consideration. The right lung is larger than the left in the ratio of 11 to 10; the right bronchus is larger than the left in the ratio of 10 to 8, and it is but half the length of the left. The average angles made with the sagittal plane by the bronchi are 25° for the right, and 45° for the left bronchus. The lungs receive blood of two kinds and blood from two sources :

venous blood from the pulmonary arteries and arterial blood from the bronchial arteries, and to a very small extent from some branches of the pericardico-phrenics. The pulmonary arteries enter the hilus of their respective sides, and arrange themselves closely to and in conformity with the plan of the bronchial tree system of their respective lobes. The pulmonary arteries show a general tendency to assume a position above and slightly dorsal to the bronchi, and the pulmonary veins arrange themselves below and ventral to the air-tubes. There are no anastomoses between the pulmonary arteries of *adjacent* lobes or contiguous lobules; there may be, however, some anastomosing between the capillaries of the pulmonary and the bronchial arteries, and, if so, it is more probably indirect and effected by the venous radicles of the pulmonary vein. The arterial blood going to the lungs is almost wholly by way of the bronchial arteries. Some minute branches from the pericardico-phrenic arteries reach the lower ventral aspect of the trachea and the lung root. Some of the arterial blood carried by the bronchial arteries is returned to the left atrium by the pulmonary vein, the larger part is perhaps returned by the bronchial veins, the right emptying into the vena azygos, and the left into the vena hemiazygos.

The bronchial arteries, usually three in number, one for the right lung and two for the left lung, enter the hilus of their respective lungs on the dorsal aspect of the bronchus, and ramify along the various branches of the bronchial system. These arteries supply the bronchi, bronchioles, and terminal respiratory bronchioles, the vessel walls of the pulmonary arteries and veins, the lymphatics, and the proximal parts of the parenchmya, and in so doing they may form capillary anastomoses with the pulmonary arterioles on the air-sacs by way of the venous radicles as before mentioned; some branches likewise go to the

surface of the lung and supply the pleura, in part. The more distal parts of the lung units or lobules are supplied by the pulmonary capillaries only. After entering the hilus of the lung, the branches of the bronchial arteries do not anastomose with each other—they are terminal for the area for which destined. The differences in the origins of these arteries and their relations are, for the purposes of this paper, of special importance. As with all other arteries, variations and anomalies occur, and such departures from the normal or average are to be kept in mind here as elsewhere.

The right bronchial artery arises from the aorta directly or from the first aortic intercostal. In either event, it passes across the ventral surface of the vertebral column and between it and the esophagus, thoracic duct, superior vena cava, and vena azygos, on its way to the right pulmonary hilus, where, on the dorsal aspect of the bronchus, it divides into its branches for the supply of the three lobes of the right lung. Its length is from $3\frac{1}{2}$ in. to 4 in. In its course it is in intimate and extensive relation with the intertracheo-bronchial and right tracheo-bronchial glands, to both of which groups it gives branches of supply. Within the hilus and the substance of the lung it or its branches are in very close relation with the broncho-pulmonary and pulmonary glands. In its course it is also in relation with the vagus and vago-sympathetic plexus on the dorsal aspect of the right bronchus.

The left bronchial arteries are two in number, and pass directly ventrally from the aorta to the left hilus, where they break up into their branches of distribution, having run a course of not more than $\frac{1}{2}$ in. to $\frac{3}{4}$ in. in length. Anastomoses may occur between the two before dividing into their branches of distribution to their respective lobes. The left bronchial arteries are in relation only with the tracheo-

bronchial and broncho-pulmonary glands of their own side, which they supply. Because of the shortness of their course they are not by any means in as extensive relation to the tracheobronchial glands of their own side, as is the right bronchial artery to its groups of glands. The distribution and relations of the left bronchial arteries within the lung are similar in all details with those of the right arteries.

The lymphatics begin in the interlobular areas, and pass through to the root of the lung closely associated with the bronchioles, bronchi, and blood-vessels. The lymph nodes developed in connection with the lymphatics for the purpose of description may be divided into four groups :—

(1) The pulmonary glands, small but numerous, are situated along the courses of the small bronchioles and blood-vessels.

(2) The broncho-pulmonary glands, a continuation of the pulmonary chain, are located along the larger branches of the bronchi and vessels, and particularly in the angular intervals between the branches of the air-tubes.

(3) The intertracheobronchial glands, relatively quite large, and from ten to twelve or more, are situated in the interval between bifurcation of the trachea.

(4) The right and left tracheobronchial glands are situated in the respective angles between the trachea and the bronchi; the right, five to nine, are more numerous than the left, three to four.

The relations of the broncho-pulmonary and pulmonary glands to the bronchi and bronchioles and to the bronchial and pulmonary arteries are particularly important. Many of these glands are situated in the angles between the branching bronchi, and at these same points the arteries are likewise branching. Compression to the extent even of complete occlusion of the arteries could here readily take place, because

the rigidity of the air-tubes on either side prevents the easy expansion of the enlarging gland into the otherwise very yielding pulmonary substance.

Having presented briefly the accepted or generally held facts, opinions and other considerations relative to the etiology of pneumonia, and the anatomical features of the lungs that appear to have any illuminating relevancy to the peculiarities of incidence exhibited by the disease, I shall now endeavour to apply the hypothesis with which I started out, and try to show how far it meets all of the general and special demands that are required of an explanation to be accepted as reasonable, if not actually true.

As previously mentioned, present evidence apparently justifies the opinion that the pneumococcus produces pneumonia only when the resistance of the lung has been lowered by the action of some unusual cause, a cause that most frequently brings as its effect a *locus resistentiæ minoris* in the lungs. Of the current or hitherto offered explanations but two would operate to produce a localized region of lessened resistance—namely, direct trauma to the lung substance, and obstruction of a bronchus or bronchiole following the entrance of a foreign body into the trachea. Both of these events have been followed by pneumonia, but neither of them appear as causative factors in the greater number of pneumonias. On the other hand, the hypothesis now presented, and which, as far as I am aware is original, is capable of producing a region of minor resistance by virtue of pressure of an enlarged gland or glands upon the arterial channels supplying the given part and thereby causing a temporary or more prolonged period of relative or absolute starvation of the parenchymatous tissues of the particular region.

That enlarged glands have by pressure interfered with the vascular supply of other parts of the body is well known, and

I take it as self-evident, that from the relations sustained by the glands of the respiratory system or those in close relation thereto, and which have been previously referred to, that these glands are equally capable of producing the same effect with respect to the lungs.

Cruveilhier many years ago called attention to the fact that the pulmonary glands were so intimately associated in the parenchyma of the lungs with the blood-vessels that when hypertrophied the pulmonary arteries might be compressed by these glands, also the bronchi. My own dissections have demonstrated that, so far as the tracheal and tracheobronchial glands are concerned, hypertrophy of these glands has compressed in several instances, and occluded absolutely in one instance, branches of the bronchial arteries. I show two semi-diagramatic drawings illustrating these facts. These drawings are made from sketch drawings of actual dissections. Fig. 1 shows a dorsal view of the root of a pair of lungs in which the right bronchial artery was displaced dorsally by a large indurated gland that intervened between the artery and the hyparterial bronchus. There was decided evidence of distortion in the course of the artery, but none of actual compression. These lungs were of a dissecting room cadaver of unknown history. Except for general glandular enlargement and some indurated spots in the right apex, there was no other evidence of lung disease, death being due to some other cause. Fig 2, also a dissecting room cadaver of unknown history, shows excessive glandular enlargement of all the glands at the root of the lung, and, in addition, there was enlargement of the tracheal and esophageal groups. This case was particularly interesting; first, because it showed two enlarged glands catching an artery between themselves, and squeezing it till there remained nothing left but a fibrous thread; secondly, that both lungs were solidified,

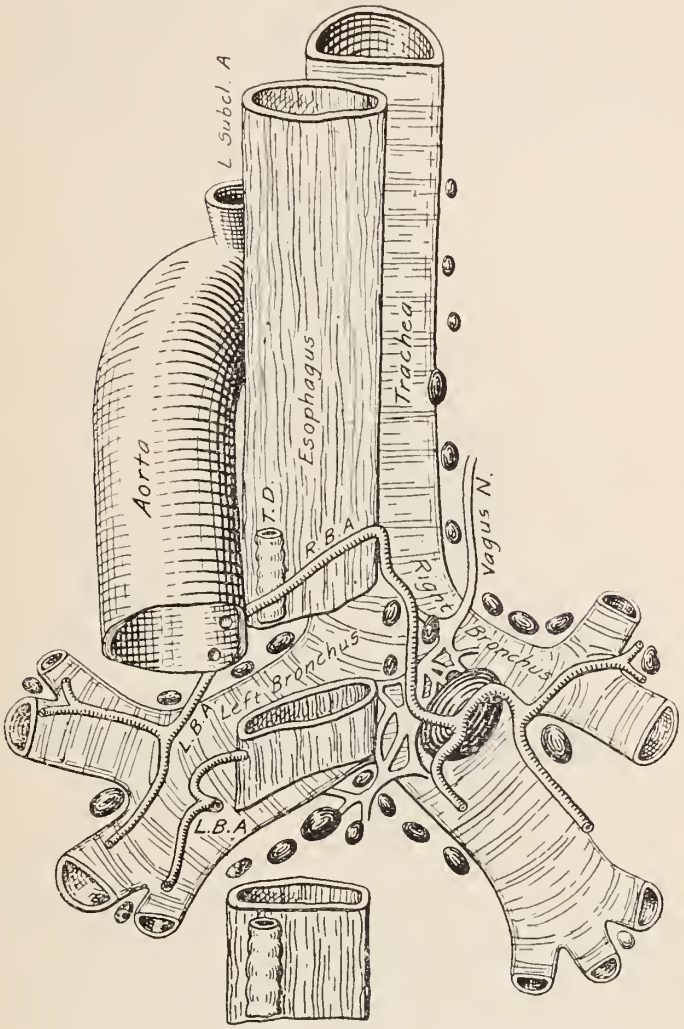

FIG. 1.—Diagram of root of lungs, dorsal view, aorta, esophagus and thoracic duct cut away in part. Drawn from actual dissection of adult male negro, age and cause of death unknown. This diagram shows the usual origins, courses and relations of the bronchial arteries and lymph glands, except that one of the right lymph glands was greatly enlarged and displaced dorsally the right bronchial artery, but without apparent compression. The position of the right vagus nerve is also indicated.

R.B.A.—Right bronchial artery.
L.B.A.—Left bronchial arteries.
T.D.—Thoracic duct.

sank in water, and in all appearances resembled pneumonia of the massive type; and thirdly, because it showed an arterial anomaly—namely, but one left bronchial artery instead of two; and a still further anomaly, a branch of this left

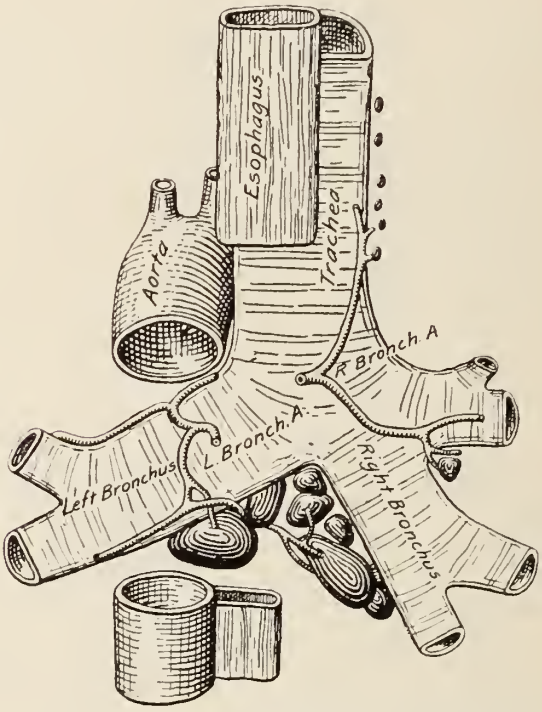

FIG. 2.—Diagram of root of lung, dorsal view, drawn from actual dissection of adult male negro, age and cause of death not known, but both lungs were solidified and sank in water, general appearance of double massive pneumonia. Aorta and esophagus partly cut away to show bronchial arteries and lymph glands. The lowest right hand branch of the left bronchial artery is seen crossing to the lymph glands of the right bronchus, and where it passes between the two glands of the left bronchus it was compressed and absolutely occluded by the pressure exerted upon it by these two glands, which were much enlarged and indurated.

bronchial artery going to the two lower lobes of the right side (see fig. 4). So far as could be ascertained this branch was the sole supply for these two lobes. It was not practicable to

recognize the right bronchial artery as a branch of the aorta or of an aortic intercostal; it was also not practicable to follow out in detail all the arterial branches discovered. The cadaver was one that, prior to my noticing the pneumonic condition of the lungs, had been used by students in the course in topographic anatomy, the thorax had been opened and the mediastinum examined from the front; also the arteries were uninjected, and the glandular enlargement was extraordinarily massive and had occasioned great distortion of the lung root region. Likewise, the adhesions resulting from the adenopathy were exceedingly dense and tough. All this made dissecting difficult and in certain places impossible. However, what is represented in the figure is diagramatically correct as shown. A branch that probably was the right bronchial artery, or an artery that was intended to take the place, more or less completely, of the right bronchial is shown in the figure. The cut end shown was traced to the esophagus, where it seemed to originate in or break up into an anastomotic network on the esophagus; which, could not be positively stated. When followed laterally this branch soon divided into two, one going cephalically along the right lateral border of the trachea, giving off branches of supply to it and to the lateral tracheal glands, which were the only glands not conspicuously enlarged; the other branch passed laterally to the eparterial bronchus and to some glands in the angle between it and the hyparterial bronchus. Arising from the aorta at about the level of origin of the bronchial arteries (see fig. 3) were two arteries going to the right and on to the dorsal surface of the esophagus. Here they appeared to break up into small branches, and could not be further traced. In connection with these two arteries, they were both observed to pass dorsal of a very large esophageal gland, as shown in the figure, which was deeply grooved by

them, and which in turn evidently exerted upon them considerable pressure. This gland likewise had displaced the thoracic duct to the right, and had sunk itself well into the dorsal wall of the œsophagus. Recurring to the occluded artery (fig. 2), it will be seen to be a branch of the left bronchial and to have been originally distributed to the intertracheal group of glands. When its connexion was virtually severed from the left bronchial artery by the glandular compression, arterial anastomoses from some other sources of

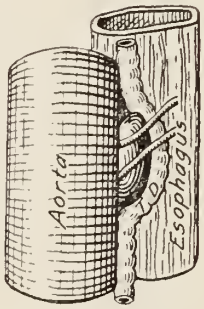

Fig. 3.—Diagram of dorsal view of cut out section of aorta and esophagus of Fig. 2. It shows a very large lymph gland displacing the thoracic duct and also compressing (dorsally against vertebræ) two arteries, one probably the right bronchial

blood supply to these glands were established which used the distal portions of this artery as means to reach these glands, but just how could not be ascertained, for reasons previously stated. An examination of the relations shown in figs. 1, 2, 3, and 4 will convince one that enlarged glands about the root of the lungs can be a source of danger in more than one place.

Fig. 5, a diagrammatic sketch of a sagittal section $1\frac{1}{2}$ in. to the left of the mid line of a cadaver dying from rupture of the superior mesenteric vein, shows the intimate relation of the pulmonary glands to the bronchial arteries,

and indicates how easily compression of these arteries could take place should the glands become hypertrophied. This figure is introduced to emphasize the possibility of pressure upon the arteries that are potential in the pulmonic glands.

Fig. 6 is a photograph of a coronal section of a female

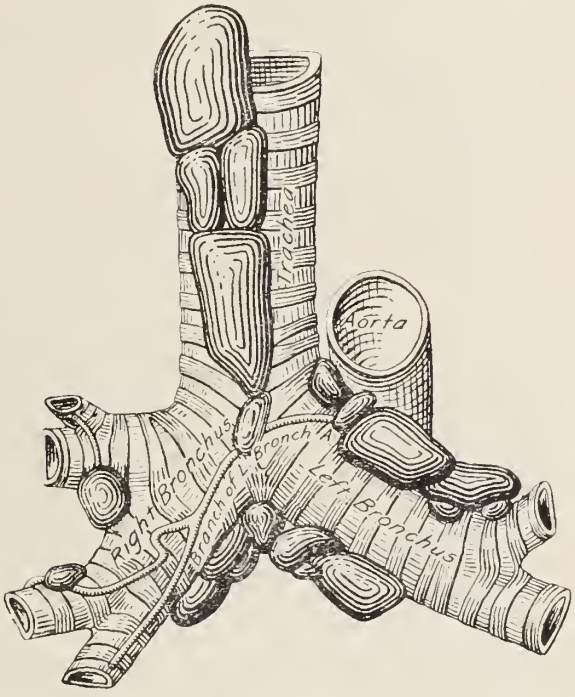

FIG. 4.—Diagram of ventral view of Fig. 2. Shows enormously enlarged lymph glands, and an abnormal right bronchial artery, being here a branch of the left bronchial artery. Its relations to enlarged lymph glands are to be noted.

cadaver, the history of which was unknown, but the appearance of the lungs showed beyond a shadow of a doubt that the cause of death was acute lobar pneumonia, the upper and lower lobes of the right lung being in the stage of grey

hepatization, and the middle lobe showing marked hyperæmia. The specimen being prepared primarily for museum purposes and forming one of a series of coronal sections of

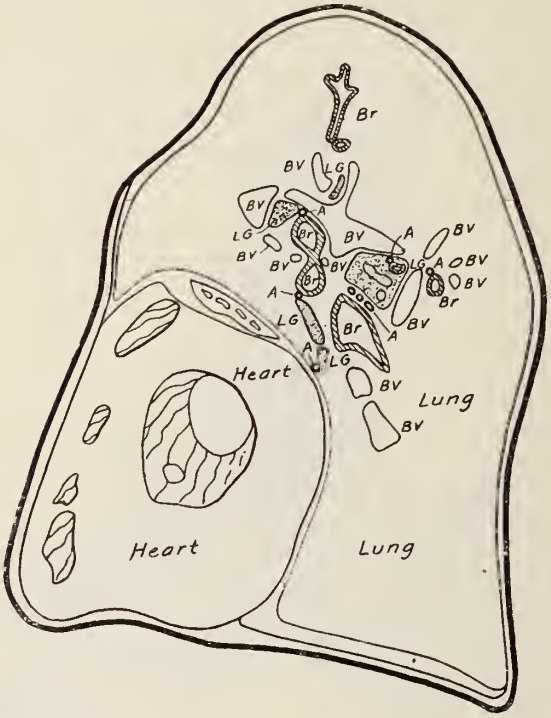

FIG. 5.—Diagram of sagittal section, one inch to left of medial plane of lung of adult negro, male, age about 30 years; cause of death, rupture of superior mesenteric vein, lung normal, except that largest lymph gland shows two caseous areas, indicated by lighter shading. Particular attention is called to the relations of the bronchial arteries to the bronchi and lymph glands.

BV—Blood-vessels, pulmonary arteries and veins, cut obliquely.
A—Bronchial arteries.
Br—Bronchi.
LG—Lymph glands.

the same cadaver, I did not feel that I could despoil it to seek for evidence as to the validity of my present hypothesis. It is presented here simply to show the marked enlargement of

FIG. 6.—Photograph of coronal section of thorax of negress, age 26; cause of death, acute lobar pneumonia; ventral view. Note the greatly enlarged tracheal glands of the right side, appearing as large dark masses between trachea and right lobe. Right upper lobe in stage of grey hepatization; other lobes, hyperæmic.

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the tracheal and mediastinal glands that prevails in pneumonia, and by inference the probability that this enlargement was not without pressure effect upon the bronchial artery of the right side.

Since making these dissections it has not been my fortune to be able to examine any other pneumonia cases, therefore, statistically, this hypothesis rests upon but one actual dissection of a cadaver dead of pneumonia. However, the hypothesis, when applied to the accepted statistical facts relative to the etiology of the disease, appears to satisfy them more plausibly than any other explanation hitherto offered.

Thus, in the marked increase of pneumonia with advancing age, the fact is admitted that the glands of the lungs and the mediastinum progressively increase in size from continuous absorption of dust and other foreign particles, as also from a continued succession of pathogenetic conditions to which they are subject. Therefore, this increase in size with age would increase the potential probability of interference with the bronchial (or pulmonary) arteries, rendering every acute enlargement more and more liable to compress any contiguous vessel.

The more frequent occurrence of pneumonia among men is consistent with the greater exposure of men to causes bringing about glandular enlargement generally; and particularly is this so in those engaged in dusty trades and work, again rendering more potential interference with the blood supply of the lungs, as postulated in the hypothesis. And further substantiation of this presumption as being an actuality would appear to be afforded by the equality of pneumonic incidence in the sexes when exposed to identical environmental conditions, as in prisons.

The reported greater fatality of the disease among negroes may be also due to a possibly greater pressure interference

from glandular enlargement, due largely to the decidedly greater prevalence of syphilitic and tubercular diseases in this race.

The greater prevalence of the disease among outdoor workers is but a corollary to what was observed regarding the incidence difference between the sexes. Outdoor workers, especially those exposed to cold and wet, certainly appear to be more frequently troubled with sore throats and other kindred affections involving glandular irritation or inflammation with its concomitant acute or chronic hypertrophy, &c.

The remarkable frequency with which the disease recurs in the same individual is eminently consistent with this hypothesis; for if the arterio-glandular relations be such that glands when enlarged from any cause compress the blood-vessels they may do so repeatedly—that is, as often as they suffer recurrent enlargements. Trauma of the chest is but a parallel instance of interference with blood supply; and the prevalence of pneumonia in the coldest months of the year is but another variant of the fact that cold and exposure are recognized provocatives of glandular enlargements.

That children under 6 are more prone to lobar pneumonia than older children may be due to the fact that they live nearer to the ground or floor, and that their mode of locomotion and their general habits expose them more to dust inhalation and the consequent potential acute glandular involvement resulting therefrom than do the living and general habits of their older, yet still youthful, brothers and sisters.

The pathological fact that the right lung is more frequently the seat of pneumonia is not only consistent with this hypothesis, but actually demanded by it, because the greater length of the right bronchial artery—three times that of either of the left arteries, and its more extended course

through and among the intertracheal and right tracheobronchial glands—render it more likely to pressure interference from these glands. The prevalence of basal pneumonia in either lobe, or both lobes, is but a corollary of the foregoing: the arteries to the lower lobes run a considerably longer course than the arteries to the upper lobes, and therefore their chance of obstruction is correspondingly greater. Then, too, the longer the course of an artery the greater is the effect of a given degree of pressure in diminishing the quantity of blood delivered in the unit of time as compared with that of a shorter vessel; such as the arterial vessels supplying the lower lobes, as compared with those supplying the upper lobes, and the one supplying the right lung as compared with those supplying the left lung.

The apparent freedom of the region of the root of the lung from involvement is indirect evidence of this last proposition, since this region, being nearer the source of the blood supply, would suffer less if compression took place between the root of the lung and the aorta than would the more peripheral portions; whereas, if the compression occurred from a gland more distant from the root, the compression effect would be *nil* in the root region, and its exemption, in greater or less degree, from disease would be obvious. The fact that the central part of the involved lobe appears usually in a more advanced stage of disease than the circumferential parts would also appear as favouring the hypothesis or indicating, as it apparently does, that the area farthest removed from its blood supply is usually the one most often affected. It is apparently an anatomical fact that the central region of the lung lobule is the most distal region with respect to blood supply.

To summarize: Acute lobar pneumonia is a disease affecting the lungs of specific bacterial causation, showing certain

characteristic peculiarities in its manifestation, among which are notably the restriction of the pathologic process to a portion of the particular lung in which the lesion first develops, and a remarkable tendency, when not fatal, to recur in the same individual and the same portion of the lung. (2) That the disease, while showing a remarkable tendency to remain in a particular region of the lung in a given case, shows also an almost equally characteristic tendency to vary its locus of manifestation in any extended series of cases. In other words, while characterized by a localized lesion the locus may be in any part of the lungs, though, in a series of any considerable number, the part in which the disease is most often observed is the lower lobe of the right lung. (3) That there is no anatomic difference of lung substance that would appear to account for the localizing characteristics of the disease. (4) That the specific germ causing the disease is not capable of its own pathogenicity of developing the disease. (5) That in order to account for the occurrences of pathogenetic powers in the germ it is necessary to postulate a cause or causes, usually extraneous, that in some way create a region of local lowered resistance of the pulmonary tissues, permitting the growth of the specific germ in pathogenetic sufficiency. (6) That, up to the present, the hypotheses regarding the nature of the hypothetic causes bringing about a *locus resistentiæ minoris* have not appeared adequate to account for the generality of the facts observed. (7) That anæmia of a tissue is recognized as an efficient cause of loss of resistance. (8) That the relations of the glands of the respiratory tract to the blood-vessels of the lungs are such that enlargement of the glands may, and sometimes do, compress these blood-vessels, thereby bringing about an anæmic state of greater or lesser degree, in both quantity and duration. And (9) that the hypothesis here presented

appears applicable to and satisfies apparently the, at present known, facts regarding the predisposing conditions necessary to be established before the disease can be inaugurated.

In conclusion, I wish to reiterate that what has been here presented as an anatomical explanation of certain features of lobar pneumonia is hypothesis, offered as such, and entitled only to be so regarded until it be either substantiated by further investigation, or supplanted by a more plausible one, or the whole question involved correctly solved by finding out the truth of the matter.

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